

# MONTHLY WEATHER REVIEW.

VOL. XXI.

WASHINGTON, D. C., OCTOBER, 1893.

No. 10.

## INTRODUCTION.

This REVIEW for October, 1893, is based on reports from 3,146 stations occupied by regular and voluntary observers. These reports are classified as follows: 159 reports from Weather Bureau stations; 40 reports from United States Army post surgeons; 2,121 monthly reports from state weather service and voluntary observers; 29 reports from Canadian stations; 217 reports through the Southern Pacific Railway Company; 500 marine reports through the co-operation of the Hydrographic Office, Navy Department, and "New York

Herald Weather Service"; 154 weekly reports from 39 U. S. Life-Saving stations; 41 reports from navigators on the Great Lakes; monthly reports from local services established in all states and territories; and international simultaneous observations. Trustworthy newspaper extracts and special reports have also been used.

The WEATHER REVIEW for this month has been prepared under the general editorial supervision of Prof. Cleveland Abbe.

## CHARACTERISTICS OF THE WEATHER FOR OCTOBER, 1893.

### LOW AREAS.

The principal areas of low pressure have been those attending the hurricane of the 1st and 2d in Louisiana and that which passed from the middle Atlantic October 1st to the south Atlantic coast October 12th, and thence northward over the lower lake region on the 14th; finally the depression attending the whirlwind that formed on the 21st north of the Bahamas and disappeared in Maryland on the 23d.

The first of these storms was remarkably severe and destructive over a small region in southern Louisiana and Alabama, and a great loss of life was caused by the high water that attended it.

The second was barely felt in the West Indies, as its track lay to the north of those islands; at Nassau the wind attained a storm velocity; on the coasts of Georgia, Florida, and South Carolina the storm was very severe and the ocean water rose to an unusual height; after reaching the lower lake region the storm was again very severe, being in most

places considered as the severest that has been experienced on the Lakes for many years.

### TEMPERATURE.

The average temperature was in excess from 4 to 7 in the lower Saint Lawrence valley, New Brunswick, and Cape Breton, and to a less extent as we proceed westward to the upper Mississippi and lower Missouri valleys and southward to the middle Atlantic states. The temperature was below the normal about 4 or 5 in central Oregon and Washington, Assiniboia, and Manitoba and southward to the south Atlantic and Gulf States and California.

### PRECIPITATION.

The precipitation was largely in excess of the normal over the northern plateau and north Pacific coast regions. It was decidedly below the normal over the middle and southern plateau, the south Pacific coast, the middle and southern Rocky Mountain slopes, western Gulf states, and Missouri Valley regions.

## ATMOSPHERIC PRESSURE (expressed in inches and hundredths).

The distribution of mean atmospheric pressure reduced to sea-level for October, 1893, as determined from observations taken daily at 8 a. m. and 8 p. m. (75th meridian time), is shown by isobars on Chart II, which also gives the so-called prevailing winds, or those most frequently observed at each station.

The normal distribution for October of atmospheric pressure and the direction of the normal wind resultant for each station is shown on Chart V. This chart has been prepared by Prof. H. A. Hazen, who has also prepared all the others of this series preliminary to the publication by the Weather Bureau of specially prepared data and charts showing the meteorological and climatic features and conditions of the United States. The pressures for both Canada and the United States are reduced to sea-level but not to standard gravity by Prof. Hazen's methods and formulæ. The wind resultants are as given by him at page 124 of his "Meteoro-

logical Tables," and are computed by Lambert's formula, giving equal weight to each observed wind without regard to its velocity.

As compared with the preceding month of September the mean pressure for October, 1893, is slightly lower in the upper lake region and the extreme south Atlantic coast, the maximum change being a fall of .09 at Jupiter Inlet, elsewhere the pressures have generally risen; the rise is .15 or more throughout the Rocky Mountain region, the maximum being .20 at Salt Lake City. A decided rise has also occurred in Maine and the Gulf of Saint Lawrence, the maximum being a rise of .15 at Grindstone Island in the Gulf of Saint Lawrence.

As compared with the normal for this month the pressures for October, 1893, have been in excess in the middle Atlantic states, New England, New Brunswick, and Nova Scotia, the maximum being from .08 to .10 in the latter provinces. Pressure has also been in excess, but to a less extent, over Texas,

the Rocky Mountain plateau, and the Pacific coast. Pressure has been below the normal in the eastern Gulf and south Atlantic states, the Ohio, Missouri, and Mississippi valleys, the Lake region, and thence to Saskatchewan; the maximum deficit is from .07 to .09 over Lake Superior and Manitoba.

#### HIGH AND LOW AREAS.

The paths of the centers of high and low areas moving over the United States and neighboring regions are shown on Charts IV and I, respectively, and their principal characteristics are described by the editor in the following text and tables. The attention of the reader is called to the fact that the movement of these so-called centers is not synonymous with the movement of the atmosphere as such. The highest pressure in a high area, like the lowest pressure in a low area, is a *locus* or place at which certain effects are produced by the movement of the air, which effects are combined with the static pressure that would prevail if the air were not in motion. Just as the movement of a cloud or a wave has but a secondary relation to the movement of the air or the water within them, so the movement of the high pressure is the result of a much more rapid movement of the upper air as it descends and strikes against the earth's surface. Centers of high pressure, like those of low pressure, may remain stationary while the individual particles of air are moving within them with great rapidity. A general depression may have several centers of minima, and a general elevation may have several centers of maxima; the movement of the whole region of elevation or depression may differ from the movement of the centers of high or low within them, the latter being usually more rapid than the former; the movement of centers differs from that of the air within them, being usually slower.

#### HIGH AREAS.

I.—This is a continuation of No. IX of September, which now moved eastward and disappeared on the 3d north of the Saint Lawrence.

II.—This is a continuation of No. X of September, and on the morning of the 1st was central on the coast of Oregon. The area of rising pressure extended rapidly southeastward and on the morning of the 3d a small excess of pressure was central in northern Texas and a remnant of the area still remained on the coast of Oregon and northern California, while a region of low pressure had extended in between, coming from the north and the south simultaneously on the afternoon of the 2d. This remnant on the Pacific coast must be considered as the eastern edge of the large area of high pressure over the Pacific Ocean.

III.—The remnant of high pressure just spoken of pushed eastward on the 4th while depression No. VI was developing on the eastern slope of the Rocky Mountains far to the southward of the center of low No. IV. This must again be considered as a southeastward movement of the upper atmosphere over the Pacific high area and in response to the deficit on the eastern slope. We must conceive of these upper layers as representing air that is flowing from the equatorial regions northeastward but cooling by radiation and settling downward and ready at any moment to slide down along the steepest available gradient to the earth's surface, while at the same time the resistances of that surface impart to the descending air the centrifugal tendency that drives it back again toward the equator; thus the northeastern flow of the upper air is converted into a southeast flow (or a northwest wind) when this cold, dry air reaches the earth's surface. In general any region of cold, dry northwest winds at the earth's surface represents the first stage of the return toward the equator of air that a short time before had been flowing from the equator as an upper current. As soon as the surface resistances have diminished the surplus energy of the northwest wind it becomes a northerly, and soon after that a northeast

wind, and merges into the general northeast trades of the tropics.

IV.—On the north side of low No. III there followed a slight barometric rise, the center of which was located in Virginia on the morning of the 5th; it was at Cape Cod on the morning of the 6th, and off Nova Scotia on the morning of the 7th.

V.—On the morning of the 9th, and in the rear of low No. VIII, the barometer was high in Manitoba while low No. IX was developing over the northern plateau region. This high moved southeastward, and by the morning of the 10th had merged with high No. III. On the 12th it was central south-east of New England, after which it disappeared.

VI.—This area originated in a manner similar to that of Nos. II and III; the extensive area of low pressure (IX) prevailed over the eastern slope on the 10th, and an area of high pressure moved northeastward over Oregon and northern California into Alberta, Assiniboia, and Manitoba, being central in Idaho on the morning of the 11th. The upper air represented by this rapid advance must have become rapidly dissipated in its circulation around the three areas of low pressure, Nos. IX, VI, and XIV, so that on the morning of the 12th this high pressure extended as a narrow ridge from Oregon southeast to Colorado, and thence northeast to Minnesota and beyond; the maximum barometric departures from normal were at that time at Salt Lake City, Utah, Winnemucca, Nev., Eureka, Cal., and Roseburg, Oregon.

VII.—The retreat of the Pacific high area on the 12th, as just described, was immediately followed by a decided advance on the 13th, at which time the highest pressure was central in western Montana. The barometer at that time was very generally below the normal over the region east of the 100th meridian under the influence of the hurricane (low No. X), and so continued during the next day, consequently a great flow toward the southeast occurred. On the morning of the 13th the area of high pressure extended from Saskatchewan to Texas, covering the whole Rocky Mountain region and Pacific slope. On the morning of the 14th its eastern boundary had moved eastward to Minnesota and Mississippi; the western boundary extended from Yuma northward to the middle of British Columbia, but within this region the area of greatest barometric departure covered eastern Colorado and western Nebraska, having moved rapidly southeastward.

On the morning of the 15th the highest pressure was central in Arkansas, and an extensive area of frost prevailed thence eastward to South Carolina, northeastward to Lake Michigan, and northwestward to central Kansas, where, however, frost had also prevailed on the 13th. This is a remarkable illustration of the general rule that frosts, which depend essentially on the radiation upwards through a perfectly clear sky, are liable to be especially severe on the north and east sides of the center of a high area. On the morning of the 16th pressure was highest in West Virginia, and frost prevailed throughout the interior of the south Atlantic and Gulf states, southwest Virginia, Ohio, Michigan, Illinois, Arkansas, and northeastern Texas; the included area being, therefore, principally on the southeast, southwest, and northwest sides of the central high.

On the morning of the 17th the pressure was highest in western Pennsylvania and western Virginia and the frost area prevailed from North Carolina and Tennessee northeastward to New York and Maine, being quite symmetrical with regard to the central high. On the morning of the 18th the greatest departures from the normal were in the lower Saint Lawrence valley, while the subsidiary high remained central in western Virginia. This reinforcement at the north was evidently due to the influx of air from farther north, as shown by the northerly winds in Canada, and constituting essentially a new area of high pressure, No. VIII.



VIII.—This area descended in the early morning of the 18th southward into the Saint Lawrence Valley and joined No. VII on the 19th over New England. On the morning of the 20th pressure was highest off the coast of New England.

IX.—While low area No. XII was moving southeastward over Alberta into Montana on the 15th, the circulation around the low area of the Aleutian Islands drew the high area from the Pacific Ocean again northeastward, and by the morning of the 16th it was pushing over the coast of Oregon into Nevada, and by the morning of the 17th pressure was highest on the coast of Washington and British Columbia. This area then stretched as a long ridge southeastward over Idaho and Wyoming, where it was central on the 18th and 19th, respectively, to Texas, which it reached on the morning of the 20th, at which time pressure was above the normal at every station with one or two exceptions on the U. S. weather map. There had evidently been a general movement of the air in the upper strata, which is only faintly indicated by the movement of the central highest pressure. In general, the high pressures are as much the results of atmospheric movement as are the low pressures, and like them do not represent static conditions. The change in the isobars on the 18th–21st argues for the existence of a general descending current producing high pressures throughout the United States, but the highest pressures were not necessarily in the center of the whole region.

On the morning of the 20th the ridge of high pressure extended from British Columbia to the coast of Texas; the highest pressures of area No. IX still remained in Wyoming and western Montana, while the equally high pressures of area No. VIII existed at the same time on the coast of New England. During the rest of the day the ridge over the Rocky Mountain plateau was broken up and replaced by low area No. XIII. The upper air evidently moved eastward, and on the 21st the morning pressure was high in Arkansas and also on Lake Superior. The latter region of high pressure represents the northern portion of the extensive area of October 20th, which had now, by its southeastward motion, come into the limits of our maps. The southern end rapidly dissipated, but the northern end was on the morning of the 23d southeast of Nova Scotia and on the morning of the 24th south of Newfoundland. The development of this high area during the 19–20th bespeaks the existence at that time of an area of low pressure on either the Pacific or the Gulf coast of Mexico, or possibly in the Caribbean Sea, out of which low area No. XV was developed.

X.—On the 23d low area No. XVI prevailed on the eastern slope of the Rockies, and again pressure rose on the Pacific coast, extending rapidly over the Rocky Mountain plateau. On the 23d, in the afternoon, pressure was highest in Washington; on the 24th, in the morning, a ridge of  $+0.12$  excess above the normal extended from Washington southeast over New Mexico; this slight ridge divided into southeast and northwest portions, so that on the morning of the 25th a high area was central in Lower Michigan, while the remaining high area continued in Oregon. On the morning of the 26th the former branch was central in the Saint Lawrence Valley, while the latter stretched southeastward towards Utah.

On the 27th, in the morning, the Saint Lawrence branch had passed southeast to the coast of Nova Scotia, and the Oregon branch was central near Salt Lake City, Utah, but with an advanced area of high pressure in Texas, so that a ridge again extended from Oregon southeast to Texas; at the same time a decided movement southeastward into Alberta had produced a new central high pressure in that region. The ridge from Utah to Texas and the area in Alberta must be considered as branches from the larger Pacific area off the coast of Oregon and British Columbia. During the 27th the northernmost of these areas moved rapidly southeast, while

the southernmost remained nearly stationary, and on the morning of the 28th there was a ridge extending from Saskatchewan due south into Texas, whose highest pressures were then in North and South Dakota, but whose highest departures from normal were in Manitoba and Assiniboia.

This region of high pressure moved rapidly southward; it was central in southern Minnesota on the morning of the 29th, in southern Indiana on the morning of the 30th, and in eastern Pennsylvania on the morning of the 31st. Light frosts were reported on its southeastern side in Texas and Arkansas on the morning of the 27th; in Louisiana and Mississippi on the morning of the 28th; in Tennessee, Alabama, North Carolina, Arkansas, and Mississippi on the morning of the 29th, as also at Rochester, N. Y. On the morning of the 30th frost was again reported from the preceding states, and in addition from Virginia, Maryland, Pennsylvania, New Jersey, New York, and Massachusetts. Finally, on the morning of the 31st frost prevailed at most stations in Alabama, Georgia, North Carolina, and South Carolina, as well as in the interior of those states, and was also reported from Eastport, Me. From this date, by virtue of this frost, the yellow fever on the south Atlantic coast at Brunswick, Ga., diminished.

The ridge of high which lay nearly northwest and southeast on the 26th and nearly north and south on the 28th had by the 31st come to trend northeast and southwest from North Carolina to the mouth of the Saint Lawrence, thus illustrating a general principle that eastward motions in the upper layer of the atmosphere are more rapid at latitude  $50^{\circ}$  than at latitude  $30^{\circ}$ ; in the present case the eastward movement from the 27th to the 31st was about 1,000 miles at latitude  $30^{\circ}$ , and 2,200 miles at latitude  $50^{\circ}$ .

Movements of centers of areas of high and low pressures.

Number.	First observed.			Last observed.			Path.		Average velocities.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long. W.	Length.	Duration.	Daily.	Hourly.
<b>High areas.</b>										
I.	1, a. m.	47	79	3, a. m.	48	71	450	2.0	225	9
II.	1, a. m.	45	125	3, a. m.	33	102	1,500	2.0	750	31
III.	4, a. m.	42	125	9, a. m.	35	36	2,500	5.0	500	21
IV.	5, a. m.	37	78	7, a. m.	43	65	800	2.0	400	17
V.	9, a. m.	51	96	14, a. m.	43	62	1,900	5.0	380	16
VI.	10, a. m.	37	123	11, a. m.	43	112	700	1.0	700	29
VII.	12, a. m.	43	123	18, a. m.	39	78	2,900	6.0	483	20
VIII.	18, a. m.	47	73	20, a. m.	42	67	600	2.0	300	12
IX.	16, a. m.	44	127	24, a. m.	46	57	4,600	8.0	575	24
X.	23, p. m.	47	120	27, a. m.	44	65	3,300	5.0	660	34
Mean.									514	21
<b>Low areas.</b>										
I.	30, a. m.	38	101	2, p. m.	52	87	1,100	3.5	314	13
II.	1, p. m.	28	92	4, p. m.	39	74	1,300	3.0	433	18
III.	2, a. m.	53	113	4, p. m.	52	90	1,000	2.5	400	17
IV.	3, a. m.	38	86	3, p. m.	42	82	300	0.5		
V.	4, p. m.	37	103	7, a. m.	49	81	1,400	2.5	560	22
VI.	5, p. m.	51	115	7, a. m.	53	96	900	1.5	600	25
VII.	7, a. m.	51	126	10, a. m.	47	62	2,700	3.0	900	38
VIII.	8, p. m.	42	113	12, p. m.	37	87	2,500	4.0	625	26
IX.	5, a. m.	20	50	15, p. m.	50	60	4,400	10.5	419	17
X.	11, a. m.	51	125	12, p. m.	53	99	1,100	1.5	733	30
XI.	14, p. m.	52	116	18, a. m.	51	96	1,500	3.5	428	18
XII.	20, p. m.	51	117	22, a. m.	49	88	1,400	1.5	933	39
XIII.										
XIV.										
XV.	21, p. m.	27	76	23, p. m.	39	78	950	2.0	475	20
XVI.	22, a. m.	40	118	25, a. m.	51	65	3,000	3.0	1,000	42
XVII.										
XVIII.	25, p. m.	59	114	29, a. m.	51	60	2,500	3.5	714	30
XIX.	29, p. m.	65	110	31, p. m.	53	92	1,050	2.0	525	22
Mean.									601	25

#### LOW AREAS.

The paths of the centers of low pressure during the month of October, 1893, are traced on Chart I, and present examples of several types of disturbances: (1) those that pass southeastward over the Rocky Mountains from the northern portion of the Pacific Ocean and move eastward over our northern boundary to the Maritime Provinces of Canada; (2)

those that move much farther southeastward toward Colorado and thence northeast down the valley of the Saint Lawrence; (3) those that apparently originate out of the ill-defined low area whose easterly arm stretches northeastward over Arizona, and which becoming isolated from it by high pressures advancing from the north, develop into low areas on the eastern slope of the Rocky Mountains; (4) the hurricanes that develop in the Gulf of Mexico, Campeche, Honduras, and the Caribbean Sea; and (5) the so-called West Indian hurricane that originates at an unknown distance east of the Windward Islands. In detail these storms are as follows:

I.—The location of this storm center is rather uncertain; it moved on the 1st and 2d northeastward off the coast of Nova Scotia and Newfoundland; this is evidently only a portion of the track of the hurricane that had come up from the Atlantic, and is a continuation of the low numbered XII in the September REVIEW.

II.—On October 1st an extensive depression extended from Manitoba southward over Texas into the Gulf; the northern end of this depression centered in a region which we have called low area No. II. The southern end of this depression constituted low area No. III. No. II moved northeast and disappeared on the 2d near James Bay.

III.—This so-called Gulf hurricane advanced suddenly and unexpectedly northeastward over southeastern Louisiana on the afternoon of the 1st. The early history of this storm, like that of low No. XV, is almost entirely unknown to us at present, but it is plausible that the areas of high pressure that were pushing southward into the Gulf before these storms themselves appeared argue for the existence of a preceding low pressure much farther south, say on the coast of Mexico and Honduras. On the other hand, there often exists on the southern edge of an area of high pressure a long trough of low pressure, at any point of which a whirl may suddenly begin and thence rapidly grow into a storm; this evidently occurred in connection with lows No. XIII and XVI, and very probably explains the sudden appearance of the low No. XV on the afternoon of the 21st. With regard to low No. III, the general distribution of wind at stations along the Gulf coast would suggest that there could have been no antecedent extensive whirlwind system, and that this storm, that was so terribly destructive over a very limited region, had only existed since the morning of the 1st, and had only grown to the size of the largest tornado when it struck the coast of Louisiana.

The observer at New Orleans, La., reports:

October 1st, a severe and destructive storm began about 6.30 p. m., continuing through the night. Much damage was caused throughout the city. About 2,000 lives were lost along the Gulf coast south and east of this section. The storm was severest in the Louisiana Delta and in the Plaquemines Parish, where it was attended with great loss of life and property. A velocity of 48 miles per hour was recorded in the city at 8.20 p. m., after which the record was lost, owing to the anemometer getting out of order. A velocity of 65 miles was attained at West End, when the instrument became unserviceable.

Mr. Kerkam, as Secretary of the Louisiana State Weather Service, reports:

No complete record of the wind velocity or rainfall of the storm can be obtained, since all instruments in the path of the hurricane were blown down, and in the case of Port Eads destroyed. It is evident, however, that the wind must have blown at the rate of 100 miles per hour in the vicinity of Pointe-a-la-Hache and along the islands on the coast. While the wind worked great havoc, yet the immense wave of water that swept over the devastated section engulfed and swept away everything in its path. It is probable that the center of this hurricane passed midway between New Orleans and Port Eads on its northeast course, since the path of greatest destruction was in that neighborhood.

It is said that over 1,500 lives were lost on the coast by drowning; the destruction of property, and the orange, rice, and other crops was very complete.

Crossing Louisiana in a northeasterly direction, the center struck the coast of Mississippi a little west of the Alabama

boundary line. The following description by one who must have been very near the center is from Capt. Henry M. Davies, of the schooner "B. Frank Neally," lying at anchor at Moss Point, Miss., N. 30° 25', W. 88° 34':

I awoke and found it blowing heavy from east-southeast, barometer 29.90. (During October 1, 1893, the barometer was 29.90, and it was raining all day, with but little wind from the southeast.) I went and looked at the glass and found it at 29.70. I called the mate and told him that we were going to have a gale, the vessel at the time lying at the lumber wharf. We doubled our lines at 5 a. m.; the wind came in gusts and rain 6 a. m.; carried away head lines and dropped anchor, glass at the time 29.30; wind southeast by east, time 7 a. m.; got a hawser from starboard bow on shore. By that time the stern lines gave way, glass 29.00; no change in the wind. At 8 a. m. we were riding to two hawsers from shore and one anchor, glass 28.85, and the weather continued to blow heavier and heavier, glass 28.65, until 9.30 a. m., 90th meridian time, or railroad time, and it abated nearly to calm and gradually went around by south to southwest, and it came out heavy from west-southwest and west at 11 a. m., and continued until 3 p. m. and cleared away. It never went north of west until some time during the night. Nearly calm at 8 p. m.

The observer at Mobile reports:

Rain began 8.25 p. m. of the 1st, with rapidly falling barometer, and by 11 a. m. of the 2d a heavy southeast gale was blowing. The extreme velocity of the wind several times reached 80 miles. The rain continued throughout the day, ending at 7.30 p. m. At 2.15 p. m. the barometer began to rise, and at 2.30 began to rise as rapidly as it had fallen. Great damage was done to property. The prostrated trees lay in one general direction from southeast and south. The water was 4 inches higher than in 1852, the severest of any previous storm recorded. In the marsh truck farm section nearly every house was swept away, and farms were destroyed in Mobile County. Seven lives were reported lost.

The same observer communicates to the "Mobile Register" of October 3d an historical summary, from which we quote the following:

The first storm, accompanied by a high flood in Mobile Bay, was in 1711, when the water overflowed the newly organized town and caused its removal to the present site. 1711, September 11-13, a hurricane destroyed churches and buildings in New Orleans, and was felt at Mobile. 1732, a destructive hurricane. 1740, September 12, a destructive hurricane, lasting 12 hours, from the mouth of the Mississippi to Pensacola. 1746, hurricane on the Gulf coast. 1772, August 31 to September 3, most destructive storm as yet experienced; vessels, boats, and logs driven into the heart of Mobile; sea rose to a prodigious height; all the vessels at the Belize blown on shore; salt spray was carried inland 5 miles. 1779, August 8, hurricane suddenly advanced on New Orleans; the naval squadron of Governor Galvez of Louisiana destroyed. 1780, August 24, a hurricane more furious than that of 1779. 1781, August 23, hurricane desolates Louisiana; Mississippi Delta entirely inundated. Between 1740 and 1800, there were fifteen destructive storms. In 1813, August 19, very destructive hurricane on the Gulf coast. 1819, August 25-28, great destructive hurricane in Louisiana and Alabama. 1852, August 23-25, hurricane and highest flood ever known, except that of 1772. 1856, August 19, hurricane swept the coast of Louisiana, but was not particularly severe on the Alabama and Mississippi coasts; Lost Island was submerged and 300 lives lost. 1860, August 11, storm at Mobile; the high-water mark was 18 inches lower than that of 1852. On September 15, of the same year, another storm, whose high-water mark was 12 inches lower than that of 1852; this is the only instance in this century of two autumnal floods in the same year. 1870, July 30, storm at Mobile, the earliest hurricane on record at that place; the high-water mark was about the same as that of 1860. 1888, August 18-20, southeast gale at Mobile, with very high tide about equal to that of 1860. During the storm of the present October, 1893, the water at Mobile rose 3 inches above the flood line of 1852, and all recognize it as the worst that has hitherto been experienced here.

The observer at Pensacola reports:

October 3d, a severe storm struck this place about 4.45 a. m. Rain began at 5.20, accompanied by high wind attaining a maximum velocity of 66 miles southwest at 3.45 p. m. From 6 to 10 a. m. the average hourly velocity was 34 miles, and from 10 a. m. to noon 40 miles per hour were registered. Considerable damage was done, the greatest occurring along the water front. Railroad communication was entirely cut off by washouts, and great damage was done to shipping.

The hurricane center moved slowly northeast over Georgia to Cape Hatteras, and seems to have been dissipated on the 5th; violent winds, heavy rains, and local storms attended its progress through the south Atlantic states.

The observer at Savannah, Ga., reports:

October 3d, rain began early morning and continued at intervals until 6.50 p. m. Between 12.30 and 1 p. m. a funnel-shaped cloud was reported about one mile east of the station. It was composed of innumerable streamers extending downward to within a few feet of the ground. Its rotary motion was from right to left. The time elapsing from its appearance to disappearance was about 4 minutes, and its course was from southeast to north-



northwest. Débris was thrown toward the west and northwest. Heavy rain preceded the cloud. The stern of an iron-clad steamship, moored at the wharf, was blown 20 feet.

IV.—This depression passed from Athabasca on the 2d eastward over Manitoba on the 4th, at which time the area of low pressure had extended far southward and a new center (VI) began in Colorado.

V.—This slight depression occurred only on the maps of the 3d moving from Kentucky to Lake Erie, and represented the northern end of a large area in the southern portion of which lay the center of the hurricane called low No. III.

VI.—This area was central in Kansas on the afternoon of the 4th and was at that time at the southern end of the larger area of which low No. IV was in the northern portion; the latter possibly filled up while the former (VI) increased rapidly as to the depression and the attendant winds and rains. This center passed over the Lake region on the 6th, and is described fully in the first Lake Storm Bulletin of 1893. The southerly winds on Lakes Huron and Erie and the northwest winds on Lakes Michigan and Huron were particularly severe.

VII.—This was developing in British Columbia on the 5th and formed the northwest portion of the depression whose southeastern part was occupied by low No. VI. On the 7th, in the morning, No. VI was north of Lake Huron and No. VII in Manitoba, after which they cannot be traced separately; they either filled up simultaneously or moved far northward beyond our stations.

VIII.—This appeared as a well-defined low pressure in British Columbia on the morning of the 7th, while Nos. VII and VI then existed far to the eastward. It had apparently moved very rapidly eastward from the Pacific and so continued, with remarkable rapidity, in a due eastward course, until on the 10th it disappeared over the Gulf of Saint Lawrence.

IX.—On the 8th, while No. VIII passed from Manitoba to Lake Superior and normal or rather high pressures prevailed from the 45th to the 30th parallels, temperatures rose decidedly at the Rocky Mountain central plateau stations, the pressure began to fall, and an ill-defined low (No. IX) developed; this continued moving slowly northeastward until the afternoon of the 10th when its northern end began to fill up, and disappeared, while its southern end developed as a well-marked low area in Kansas; this moved eastward to Illinois on the 12th and entirely disappeared in Tennessee by the morning of the 13th, in the presence of the West India hurricane that was then off the coast of North Carolina.

X.—This storm was described at the time in the Lake Storm Bulletin No. 2 of 1893. From subsequent data it appears that the early history of this hurricane is even at present very imperfectly known.

The reports from the "Ida" show a high sea October 1st-3d from the southeast, with gloomy weather, at about latitude 15°, longitude 43° to 45°. I locate the hurricane center on October 3d, Greenwich noon, at approximately N. 18°, W. 45°, therefore there is some discrepancy in relation to the swell from the southeast, as reported by the "Ida".

The reports from the "Catalonia" show that a disturbance prevailed on October 3d and 4th in latitudes 19° to 20° and longitudes 48° to 50°, and I locate the hurricane center October 5th, Greenwich noon, at approximately latitude 18°, longitude 49°. On the 5th, at noon, the "Catalonia" was near the center.

The "John B. Coyle" was near the center from noon of 6th to 3 a. m. of 7th, and I locate the center at noon of the 7th as approximately 21° N., 58° W. The center passed northeast of Nassau in the early morning of the 11th, and the steamer "Ciudad Condal" passed through the center at 9 a. m. of the 12th, at which time the center was approximately latitude 27°, longitude 79°.

The following reports from Antigua and Dominica show the slow advance of this hurricane as it passed north of those islands. It should be remarked that the suggestion by the observer at Dominica, that his ocean swell from the west on October 6th was due to the action of a storm in the Gulf of Mexico on October 2d, seems entirely inadmissible, and the editor thinks it more probable that this and similar instances in the West Indies are illustrations of the fact observed by him at the Island of Ascension, *i. e.*, that a heavy swell on the east side creeps around to the other side and there produces rollers that appear to come in from the west. A similar but much feebler illustration of wave phenomena has also been observed by him at Barbadoes.

Government Laboratory, Saint Johns, Antigua. Barometer (corrected and reduced) September 30th, 29.94 but fell steadily to October 5th, 29.70, and October 6th, 29.68 all day, the wind from southwest, force 3 and 4; minimum 29.66 at 3 p. m., southwest, force 5, and stayed low throughout the 7th, south-southwest from 6 diminishing to 4. Rose steadily 8th, 9th, 10th to 29.98 on the 12th, east wind. Large waterspouts on the 10th northwest of Saint Johns from 1-2 p. m. and thunderstorm in the evening working up from the south and west. During the 6th the sky covered with thin haze.

Government House, Roseau, Dominica. Ever since October 1st most unusual weather, very hot; light northerly winds; highly colored sunsets; no rain, abnormal low barometer steadily, falling to minimum, 29.77, on the morning of the 6th, after which it began clearing and the ocean swell was from the westward; the reporter thinks this depression and swell must have come from the storm which was violent in the Gulf on October 2d; he states that on account of the high hills and mountains on the east side of the island the direction of the winds can only be judged of from the apparent movement of the clouds. His own position is on the west or leeward side of the island, having these hills and mountains on the east. At his location the sea is invariably calm when the wind is in the usual direction; his barometer is 90 feet above sea-level. His total rainfall for September is 10.79 inches on 24 days out of 30; the total rainfall for the year up to date is 66.14.

The observer at Santiago de Cuba states that: "The hurricane that originated in the Antilles moved north and was first heard of off Antigua; was north-northeast of Saint Thomas on October 7th in the morning, the outward spirals having touched the hilly lands of Santo Domingo caused the hurricane to pass so far north."

This last report illustrates the impossibility of locating the center and path of the hurricane from a few local reports; the present storm undoubtedly originated a long way east of the Antilles, and was at no time very near those islands or the Island of Antigua; the influence of the hilly island of Santo Domingo on the track of this hurricane is also very much exaggerated; cases are on record in which a hurricane center passing directly over Puerto Rico, Santo Domingo, or Cuba is somewhat deflected by the islands, but when the center, and in fact the whole whirlwind, is over the free ocean the influence of distant islands must be inappreciable.

M. Carmena, captain of the steamer "Ciudad Condal", reports the position of his vessel in the neighborhood of this hurricane center on the 11th and 12th of October. The position of the vessel was, on the 11th, noon, N. 25° 57', W. 79° 59'; 12th, noon, N. 27° 16', W. 79° 41'; 13th, at noon, N. 27° 20', W. 79° 5'. On the first date, 11th, at 9 p. m., the hurricane center was 70 miles east-northeast from the vessel. On the 12th, at 4 a. m., it was 50 miles east of the vessel, and on the 13th, at 4 p. m., it was 30 miles southeast. The barometer at these times read 748, 740, and 729 millimeters, respectively, not corrected for temperature (24° C.); the winds were north-northwest force 9, north-northwest, 11, and south-west, 11; the average speed of the hurricane center was 6 miles hourly toward the N. 70° W. The vessel had a speed somewhat greater; the maximum velocity of the wind was about 80 miles per hour. The vessel, notwithstanding the head wind from north-northwest, gained on the cyclone center and passed ahead to the northward of its track; she was in the Gulf Stream, being on her way from Habana to New York. It is probable that the center of the hurricane was farther from the vessel than the figures above given would indicate.

The high water caused by the easterly winds on the south Atlantic coast was very severe and caused much damage. The hourly record of the height of water, the wind, and other

elements as furnished by Gen. E. P. Alexander, of Georgetown, S. C., is given in the subsequent section, "Notes by the Editor," but the following extract from a letter by the same gentleman is of interest:

The gale of 1822, September 27 and 28, is the most memorable of all prior to 1893 among the traditions of this section, the loss of life being very great for those days; forty were drowned at North Inlet; twenty on Murphys Island, and probably in all 200 at various points along the coast. The storm began about 10 p. m. of the 27th and was all over by daylight of the 28th. After that gale several planters built storm towers of brick for their slaves to take refuge in. Records of high water in previous gales have been preserved by means of notches on trees, and by comparison it appears that the high water of October 13-14 exceeded that of September, 1822, and also that of August 28, 1881, by nearly 3 feet. It exceeded that of August 27, 1893, by at least 2 feet 4 inches. I have had a level taken from the inside of the North Island lighthouse tower, where the water mark is least likely to be obscured by wave action, and the level reached was 11.3 feet on the U. S. Engineer's tide gauge, whose zero mark is 1 foot below ordinary low water; this would give 10.3 feet above ordinary low and 6.8 above ordinary high water, which is 4.5 on that gauge. The popular report is that the water rose on Magnolia Beach, a sandy peninsula about 25 miles northeast of Georgetown, 6 feet above the August gale, but this needs to be verified by an expert. What between the two gales, August and October, and one or two freshets in the river, the average production of rice in all this region will hardly exceed one-sixth or one-seventh of the estimated crop. The total loss of life in this vicinity in the October storm is 22 and the loss of property at least \$250,000. Almost worse than the physical losses to the fisherman, and those who were much exposed, is their demoralization and discouragement, and loss of confidence. They are prepared to believe all sorts of absurd predictions of more storms coming, which are circulated among them without any one knowing who is responsible for them.

At Jupiter, Fla. ( $26^{\circ} 56' N.$ ), rapidly falling barometer and north winds backing to northwest began on October 11th. Heavy rain began 9.27 p. m., 11th, ending 1.22 p. m., 12th. The wind reached a maximum velocity of 72 miles from the west at midnight, 11th, to 2 a. m., 12th. Great damage was done to docks, vessels, crops, and houses. Three bodies were washed ashore in this vicinity. For many miles along the Indian River the sea broke over the peninsula, raising the river to a point never before attained. Orange groves on Indian River were injured and great damage was done to farms. From Titusville to Lake Worth ( $26^{\circ} 40' N.$ ), a distance of 150 miles, nearly all docks were washed away.

At Melbourne, Fla. ( $28^{\circ} 6' N.$ ), the water was several feet higher than it has been for several years; the storm was by far the worst since the great gale of 1880.

The observer at Titusville, Fla. ( $28^{\circ} 35' N.$ ), reports as follows:

October 11th at 8 p. m., was blowing at the rate of 52 miles steady, with a maximum of 60 miles. As the night advanced the conditions became more threatening. At 12.05 a. m. the anemometer cups were blown away, and there were several heavy squalls during the night that must have been between 80 and 90 miles per hour. Rain began 9.10 p. m. of 11th, and at 8 a. m. of 12th the amount in the gauges measured 2.20 inches. The continued north and northwest winds drove the water back from the western shore of the Indian River farther than ever before. At the end of the steamboat dock, where there is generally 6 to 8 feet of water, the bed was perfectly dry for about  $\frac{1}{2}$  of a mile. Rain ended 5.55 p. m. of 12th. One house was blown down and several small buildings moved from their foundations, and great damage to electric wires. The orange crop is badly damaged, and in some localities the ground was covered with the green fruit; two small steamers and a sailing vessel were wrecked and several docks blown away. Great damage was done to shipping.

The following extract is from a letter from Mr. E. S. Conant, keeper of the Musquito Lagoon House of Refuge of the U. S. Life-Saving Service ( $N. 28^{\circ} 50'$ ), to Commander C. D. Sigsbee, U. S. N., dated October 14th:

The storm that has just passed this station was far more severe at this place than the one of August 26 and 27, and the indications of its approach were observed for a longer period of time than were those of the approach of that storm. The sea was much higher than has ever been observed here to my knowledge. The surf by its peculiar action cutting away the bank in front of the station and several seas washing entirely under the house, which is situated about 30 yards from high-water mark. Timbers that have lain on the beach ridge for years were caught up and thrown 40 or more yards higher than they had before lain. Some of these were about 60 feet long and 2 feet square, showing that it was no small wave that handled them. The weather vane I use for getting the true direction of the wind is fastened permanently to a rod which passes down into the house, and the motion is there shown by

a dial and index hand. This gives me a very true direction of the wind, as the house is situated on a narrow neck of land, with no trees nearer than  $\frac{1}{2}$  miles.

I regret that I have been unable to obtain even the loan of an instrument to measure the velocity of the wind.

**Jacksonville, Fla.**—The northeast wind prevailed from October 7th to 11th. On the 11th at standard low tide the water was within 10 inches of the standard high tide; on the 12th, at 7 a. m., the water had risen still higher and covered the sea wall of the central basin, and at 8 a. m. was combing over the sea wall north of Fort Marion; 12th, at 10.30 a. m., the water reached its highest point, 12 inches above the sea wall, and the streets of Saint Augustine were inundated. The gale continued unabated from the north until 4 p. m. Thursday, 12th; the next regular high tide was at 11.30 p. m., but by 6 p. m. the wind had veered to northwest; the heavy rain ceased at 9 p. m. This gale and flood were said to be worse than those of the Vera Cruz, or of any other storm known to have visited Saint Augustine. Mr. J. S. Masters, one of the oldest residents, says that the tide was the highest that he has known since 1824, when he rowed a boat into the hallway of the old Mickler house on Charlotte street. According to the measurements of the United States office of River and Harbor Improvements the outer end groin, near Davidson's house, on Anastasia Island, is  $3\frac{3}{4}$  feet above mean high-water mark and the sea wall in the basin in front of the Plaza is 5 feet above mean high-water mark. The high water of October, 1893, not calculating the swell of the waves, rose at least 12 inches above the top of this sea wall.

**Wilmington, N. C.**—The storm arrived on time in accordance with the predictions of the Weather Bureau; the maximum violence of the wind was between 11 a. m. and 2 p. m. October 13th; velocity 56 miles per hour. The tide and overflow were the highest ever known here, and were much worse than that of August. At Southport the wind velocity reached 80 miles at 11.30 a. m.

**Charleston, S. C.**—The prediction of the Weather Bureau, that while the storm might pass close to Charleston it would do no material damage, has come true, and October 13, 10.20 a. m., the wind is decreasing and there is no rain.

**Raleigh, N. C.**—Barometer began to fall rapidly during the early morning of the 13th, and continued to fall until 3.20 p. m., when it read 28.67, being the lowest on record at this station. A gale began at 11 a. m. and continued until 7.30 p. m.; the most violent gusts occurred between 2 and 3 p. m.

The following account of this storm is taken from Lake Storm Bulletin No. 2:

By the evening of the 9th its approach was indicated by reports from Nassau, in the Bahamas, and southern Florida. On that date information signals were ordered on the Florida and east Gulf coasts. On the morning of the 10th brisk and high northerly winds were reported at Nassau, and signals for northeast gales were ordered at Key West and Jupiter, Fla.

By the evening report of the 10th the wind freshened to a gale at Jupiter and storm northeast signals were ordered for all Florida stations and information signals were displayed as far north as Wilmington. On the morning of the 11th the storm was apparently central east of the Bahamas and the barometer was falling rapidly over the Bahamas and at Jupiter. Northeast storm signals were ordered on the Atlantic coast from Savannah to Hatteras. Heavy southeast swells were reported on the south Atlantic and New Jersey coasts during the 11th. At noon northeast storm signals were ordered as far north as Chesapeake Bay, and information signals thence to Eastport. During the 12th severe northeast gales and heavy rains prevailed on the south Atlantic coast, and the barometer fell rapidly.

On the morning of the 13th the storm center reached the South Carolina coast, and a barometer reading of 28.88 was reported at Charleston at 6.45 a. m.; at this report the conditions indicated that the storm would move northward over the interior through the Carolinas and the middle Atlantic states. Northeast storm signals were ordered for all stations on the middle Atlantic and New England coasts. Special noon reports showed the storm central midway between Wilmington and Charlotte, N. C.; at that time northeast storm signals were ordered for Lakes Ontario and Erie and southern Lake Huron. Special warnings were sent to all Weather Bureau observers in the middle Atlantic states and New England, and observers from southern New England to Maryland were authorized to use the telegraph at their discretion in distributing these warnings in the most effectual manner possible.



Special warnings were also sent to postmasters on the New Jersey coast, and to telegraph and railroad officials in the line of the storm.

The evening report of the 13th showed the storm central over northeastern North Carolina, the storm center having passed Lynchburg about 5 p. m., where a barometer reading of 28.88 was recorded. The center passed west of Washington, D. C., about 9 p. m. and by the morning of the 14th it had crossed Pennsylvania and western New York, and was central north of Lake Ontario, a barometer reading of 28.74, the lowest noted during its passage, was reported at Toronto. Northwest storm signals were displayed at all lake stations except Duluth, and heavy westerly gales prevailed over the Lake region until the morning of the 15th. During the 15th the storm disappeared in the direction of Labrador. From the appearance of this storm east of the Bahamas on the morning of the 11th, its course was accurately forecasted and ample warnings given throughout its entire path as to its destructive character.

XI.—This area, like No. VIII, first appeared on the coast of British Columbia on the morning of the 11th; it moved rapidly eastward while No. IX was developing in Illinois, and on the 12th very low barometer prevailed in Assiniboia and Saskatchewan, and probably to the northward, but the center of this depression had disappeared by the morning of the 13th. It is impossible, at present, to say whether it disappeared by simply filling up, as was the case with area No. IX on that same day in Tennessee, or whether it simply changed its course of southeastward advance into a northeastward movement, as would seem to be plausible, judging from the analogy of those storms that descend far enough southward over the United States to have their tracks accurately mapped out.

XII.—Low area No. XI was followed by an area of high pressure moving southeastward over the Rocky Mountain plateau region, following which low No. XII appeared in Alberta on the afternoon of the 14th, while low No. X was central near Ottawa. No. XII moved slowly southward and diffused over a large area, until on the afternoon of the 16th it may be described as being the eastern angle of a depression that extended from North Dakota southwestward to the Gulf of California and northwestward to Athabasca. It then separated from these longer arms and moved northeastward until it disappeared in Manitoba on the 18th.

XIII.—The preceding low was again followed by an area of high pressure which from the 17th to the 20th advanced southeastward from British Columbia over the Rocky Mountain plateau; this was followed by low No. XIII which appeared on the afternoon of the 20th in British Columbia and moved rapidly eastward until, in the afternoon of the 21st, it was central in Manitoba. But at this time, like its predecessor, the general depression to which it belonged extended southwestward to the Gulf of California, and the morning map of the 22d shows that an extensive area of high pressure had advanced southward over Alberta and Assiniboia, almost entirely obliterating the depression of the previous map, instead of which we have now a trough (bounded by the isobars of 29.80) extending from Lake Superior southwestward to Colorado and thence westward to Oregon and northern California. The map of October 22d, p. m., shows this trough of 29.80 in nearly the same locality, inclosing a trough of 29.70 or less, out of which developed low area XVI.

XIV.—By XIV we designate the area of low pressure which frequently during October, as during previous months, has stretched north and eastward over Arizona. It should undoubtedly be considered as an arm or extension of some larger low pressure that exists permanently over the Pacific Ocean near the coast of Mexico and the peninsula of Lower California. It frequently exhibits a tendency to stretch far to the northeastward, while the low areas that descend the eastern Rocky Mountain slope show an equal tendency to stretch southwestward and make connection with the depression in Arizona or northern Mexico. Such extensions occurred, for instance, on the 1st of October, when a storm (low area No. I) was developing in the Gulf of Mexico and a high barometer was descending from Oregon; again, on the 4th, low No. VI

developed in Kansas and New Mexico and pressure was low at Yuma while a high area began to advance from Oregon southeastward to Texas; again, on the 9th, while low No. IX developed on the Rocky Mountain plateau it finally stretched from Arizona to Lake Superior, but a high area moved eastward over California, and being subsequently reinforced covered the greater part of the Rocky Mountain plateau on the morning of the 13th, obliterating the well-marked low Nos. XI and XIV; on the 13th this high area became the principal feature of the map west of the Mississippi Valley, while the hurricane, low No. X, was the principal feature east of that river. On October 15th low area No. XII was central at the northern end of a depression that extended southward over Arizona and the Gulf of California, and during the 16th to 20th this long trough was followed by a high coming over Oregon and extending southeast to the Mississippi Valley. On the 21st this high was again followed by a low area reaching from the Gulf of Mexico to Athabasca, with low No. XIII at its northern end. During the rest of the month lows in the northwestern portion of the map did not generally form a close connection with the lows at the head of the Gulf of California, but were apparently prevented by the very prompt eastward movement over California and Oregon of the areas of high pressure from the Pacific Ocean.

We may, therefore, summarily describe the phenomena for the whole month as consisting of alternate formations or tendencies to form troughs and centers of low pressure from the Gulf of California to Alberta, followed by the more or less prompt and decisive advent of areas of high pressure moving eastward over the region intermediate between these extremes. The average pressure for the month will, therefore, be low in Alberta and in Arizona, but rather higher in the intermediate region over which the centers of the high areas have moved eastward.

XV.—As above stated, the country west of the Mississippi was dominated by an area of high pressure from October 13th to 14th, and on the 15th this area was central in the Ohio Valley; on the 16th frosts and northerly winds prevailed in the Gulf States. Undoubtedly this high pressure with northerly winds extended southward over the whole Gulf of Mexico during the 16-17th, and it is not likely that this would have been the case if there had not been a decided deficit of pressure existing still farther to the southward either in Mexico or the Caribbean Sea, or possibly even on the Pacific Ocean south of Mexico. Whatever may have been the ultimate cause of this extensive southward movement of the lower layer of the atmosphere, one of its first results must have been the formation of clouds, rain, and occasional whirlwinds on the coasts of Mexico, Guatemala, and Cuba, and in the Gulf waters themselves. By the 18th this region of cloud and rain had extended northward to our Gulf coasts, the northerly winds became more decidedly easterly, and the barometer began to fall at Nassau and Key West. The conditions were at that time such as generally precede the advance of a hurricane moving westward from the West Indies, but no reports of such hurricanes have reached us. On the 21st, however, a storm-center was certainly central in the afternoon north of the Bahamas, which may very plausibly have been developed as a well-defined whirl for the first time on that day. It moved rapidly northward, becoming a gale on the North Carolina coast on the 22d; it then swerved a little to the west and disappeared in Maryland on the 23d.

XVI.—On the 22d low area XIII had become converted into a long trough, as above described. The western end of this had by the morning of the 23d become an oval depression (XVI) reaching from Kansas to Minnesota; it moved northeastward into Ontario, and disappeared on the 25th.

XVII.—This depression is first well defined on the morning of the 25th and must for the present be considered as origi-

nating in the warmer easterly winds that were then blowing toward Colorado in the rear of the high area that had just passed on to the Lake region. It developed rapidly during that day but subsequently moved northeastward as a long trough and disappeared on the 27th.

XVIII.—This depression suddenly appeared on the afternoon of the 25th in Athabasca and Alberta, while a decided high area was advancing toward Oregon. The low pressure moved rapidly eastward at the northern boundary of our map; brisk and high northwest winds with snow succeeded it in the Lake region; it disappeared on the 29th at the mouth of the Saint Lawrence River.

XIX.—This depression appeared on the afternoon of the 29th north of Assiniboia; it moved southeastward, passing over Manitoba on the morning of the 31st.

XX.—The maps of the 29th–31st show that the high pressure that was moving from the Mississippi Valley eastward was, as in the previous case of low No. XV, attended by northeast winds

and rain in southern Florida and the Gulf of Mexico, and, as in that case, so also here, local whirls existing far to the southward could develop into larger storms. On the 29th and 30th this disturbance, which had not yet assumed the form of a large horizontal whirlwind so far as shown by the daily weather map, appeared to the observer at Musquito Lagoon, Oak Hill, Fla., N.  $28^{\circ} 51'$ , W.  $80^{\circ} 46'$ , as a distant bank of clouds, which he describes as follows:

On October 29th a bank of clouds at midnight looked dark and threatening in the distant southeast. This bank moved further away and was due south during the 30th, and disappeared during the 31st in the southwest. The barometer remained high during the whole; the wind was north-northeast on the 29th; northeast on 30th; northeast, force 9, on 31st; and east-northeast, force 5, on November 1st. But little sea accompanied this storm as compared with October 10–14th.

Probably the bank of clouds thus observed in the distant south represents the location of the northern edge of the rain area but not the location of a revolving storm.

#### NORTH ATLANTIC STORMS FOR OCTOBER, 1893.

[Pressure in inches and millimeters; wind-force by Beaufort scale.]

The paths of storms that passed over the western portion of the north Atlantic Ocean are shown on Chart I, so far as can be traced from information received up to the 25th of November, through the co-operation of the Hydrographic Office, U. S. Navy, and the "New York Herald Weather Service."

The normal pressure for October over the north Atlantic Ocean, as shown by the international simultaneous meteorological observations, is highest, 30.10 (764), in two large ovals between parallels N.  $25^{\circ}$  and  $40^{\circ}$ , and central, respectively, on meridians W.  $30^{\circ}$  and  $85^{\circ}$ . The pressure is lowest, 29.70 (754), between Iceland and Greenland. As compared with September the normal pressure for October is about 0.05 less in the North Atlantic between parallels N.  $40^{\circ}$  and  $50^{\circ}$ , and meridians W.  $30^{\circ}$  to  $60^{\circ}$ .

As compared with the annual normal pressure for the northern hemisphere, the monthly normals for October show a deficiency of 0.05 from Central America eastward over the West Indies to the meridian of  $35^{\circ}$  W., and between the parallels of  $15^{\circ}$  to  $30^{\circ}$  N.

The tracks of storms for October may be classified as (1) those that begin in the Atlantic south of the parallel of  $20^{\circ}$  and after moving westward turn to the northeast; (2) those that pass from the Pacific coast between parallels  $45^{\circ}$  and  $55^{\circ}$  eastward over New England and the Canadian Provinces; (3) those that originate off the New England and Canadian coasts and pass northeastward to Great Britain and Norway. Occasionally one of the first or second class continues long enough to pursue the path followed by the third class, but this is rare.

The region of the greatest frequency of storm-centers extends from Lake Superior to the lower Saint Lawrence, where an average of 5 tracks per month cross over each space of  $5^{\circ}$  in latitude and longitude during October.

The average velocity of movement of storm-centers for October, in statute miles per hour, is 30 for the United States, when moving eastward, and 19 for the Atlantic Ocean. Before recurving the West Indian storms move at the rate of 12 miles per hour westward, and after recurving at the rate of 28 miles northeastward, but during the recurve at the rate of only 9 miles per hour. The simultaneous charts of the northern hemisphere for 1878 to 1887 show that during the ten years only one storm in the month of October could be traced across both the North American continent and the Atlantic Ocean.

During October, 1893, the following storms have been traced over portions of the north Atlantic Ocean; the centers are located for Greenwich noon by international simultaneous observations, as follows:

A. The center of this storm is located, approximately, on Chart I, for the 29th and 30th of September and for the 1st and 2d of October, as it passed northeastward some distance from the coast of Nova Scotia. The lowest barometer reported was 29.18 on October 1st, but the low pressure filled up by the 4th and the winds died away.

B. This is the continuation of the storm (F) in September; it was central in Scotland on the 1st, and extended slowly south and east until, on the 6th, two centers of low pressure and revolving winds existed, the one northeast of Scotland and the other near the Bay of Biscay, both of which continued until the 9th, after which the southern one disappeared and the northern one moved slowly northeastward, disappearing in Finland on October 15th.

C. This represents the end of the history of the incipient hurricane (low area No. III of the United States). This storm, which was a small violent whirl in the Gulf of Mexico on October 1st, passed northeastward over the south Atlantic states, and on October 5th (Greenwich noon) was central at about N.  $35^{\circ}$ , W.  $70^{\circ}$ ; it appears to have filled up rapidly on the 6th, and it has not been traced any further.

D. This is the Atlantic hurricane (low area No. X of the United States) whose track is given on Chart I as far as our limited knowledge allows. It was evidently a well-developed hurricane on the 5th, moving slowly westward at about N.  $15^{\circ}$  or  $20^{\circ}$ ; the general depression of which it was a part also included at that time the storms A and C, and covered the whole West Indies and Caribbean Sea. The storm-center moved steadily westward until it was near the Bahamas on the 12th, it then turned northward and disappeared in Labrador on the 15th.

E. The low area No. VIII of the United States, having its center far north of Canadian stations, moved east-southeast on the 10th, and at noon an extensive area of low pressure, with several subsidiary centers, extended from N.  $35^{\circ}$ , W.  $65^{\circ}$  northeastward over Newfoundland; the principal center being near the southern coast of that island. On the 11th, at noon, this was at N.  $47^{\circ}$ , W.  $45^{\circ}$ . On the 12th, at noon, N.  $50^{\circ}$ , W.  $42^{\circ}$ , barometer 28.85. On the 13th, N.  $49^{\circ}$ , W.  $40^{\circ}$ . On the 14th, N.  $50^{\circ}$ , W.  $30^{\circ}$ , but stretching northeast as a trough whose other secondary center was about at N.  $60^{\circ}$ ,



W. 20°. On the 15th two centers are recognizable, one in N. 53°, W. 20° and the other in N. 59°, W. 10°, while at the same time a third center was forming in an apparently independent manner at about N. 35°, W. 25°. The northernmost of these three whirls moved northeastward over Scotland and then stretching eastward combined with *B* to form a depression that was central on the 17th over the southern Baltic and on the 18th in western Russia.

*F.* This is the center just referred to on the 15th near the Azores, it moved over those islands on the 16th, 17th, and 18th in a northwesterly direction, and at noon of the 18th was central about N. 40°, W. 30°, after which it recurved to the north and northeast and disappeared on the 20th.

*G.* This first appears as a depression north of Scotland on the 18th, and north of Norway on the 19th, after which it moved east and southeast toward eastern Russia, while a high pressure area was central over France, Germany, and Austria.

*H.* While pressure still remained high in Europe a depression appears on the 21st east of Iceland, which on the 22d is represented by a small depression in southern Sweden and another north of Norway. By noon of the 23d these had developed into a deep low pressure in Lapland, which moved southeastward beyond our maps.

*I.* The area of highest pressure in central Europe appears on the 23d as the eastward extension of the still higher pressure central west of Ireland at about N. 50°, W. 15°. To the north of this an extensive depression soon developed, which on the 24th may be located at N. 65°, W. 5°. This continued moving southeastward, and on the 26th, at noon, was central in the middle portions of Norway and Sweden. On the 29th, at noon, it was in northern Norway and Sweden, where it is also located on the 30th, at noon, with the subsidiary whirls forming near Ireland and Portugal. On the 31st it had moved southeastward towards eastern Russia.

*J.* On the 19th pressure seems to have been somewhat low over the Caribbean Sea, while it was quite high over the eastern part of the United States and the adjoining Atlantic Ocean. No reports of whirlwind storms or high winds have as yet been received, but a complete system of cyclonic winds existed over the Caribbean Sea, whose center on the 20th was approximately at N. 18° and W. 82°. On the 21st it was at N. 24°, W. 78°; on the 22d, at noon, the wind circulated

about a center at N. 30°, W. 79°, and at this time begins a definite history of United States storm XV, which broke up on the 23d in Maryland.

#### OCEAN ICE IN OCTOBER.

The following table shows the southern and eastern limits of the region within which icebergs or field ice were reported for October during the last 11 years:

Southern limit.			Eastern limit.		
Month.	Lat. N.	Long. W.	Month.	Lat. N.	Long. W.
October, 1883.....	46 56	46 22	October, 1883.....	46 56	42 22
October, 1884.....	Off Cape Race.	46 22	October, 1884.....	46 56	50 55
October, 1885.....	48 21	47 12	October, 1885.....	48 21	47 12
October, 1886.....	41 34	49 43	October, 1886.....	46 03	46 37
October, 1887.....	42 58	50 02	October, 1887.....	42 58	50 02
October, 1888.....	51 43	55 36	October, 1888.....	51 43	55 36
October, 1889.....	44 32	49 26	October, 1889.....	46 30	45 59
October, 1890.....	44 47	49 33	October, 1890.....	47 56	45 45
October, 1891.....	48 04	48 27	October, 1891.....	48 04	48 27
October, 1892.....	Straits of Belle Isle	52 34	October, 1892.....	52 34	51 00
October, 1893.....	49 57	59 32	October, 1893.....	52 47	51 16
Mean.....	46 32	50 39	Mean.....	48 15	48 41

Ice was reported south of the 50th parallel only on two dates, 8th and 11th. In an area extending from the Straits of Belle Isle to the 51st meridian ice was reported on the 1st to the 4th, 7th, 8th, 10th, 11th, 13th to 15th, 17th, 22d, 26th, 28th to 31st. The southern limit of ice was about 3½° north and the eastern limit was about 2½° west of the average southern and eastern limits of ice for October. The region within which icebergs or field ice were reported for the current month is shown on Chart I by crosses (X).

#### OCEAN FOG IN OCTOBER.

The limits of fog belts west of the 40th meridian, as determined by reports of shipmasters, are shown on Chart I by dotted shading. Near the Grand Banks of Newfoundland fog was reported on 19 dates; between the 55th and 65th meridians, on 12 dates; and west of the 65th meridian, on 6 dates. Compared with the corresponding month of the last 6 years the dates of occurrence of fog near the Grand Banks numbered 5 more than the average; between the 55th and 65th meridians, 8 more than the average; and west of the 65th meridian, 3 more than the average.

#### TEMPERATURE OF THE AIR (expressed in degrees Fahrenheit).

The distribution of the monthly mean temperature of the air over the United States and Canada is shown by the dotted isotherms on Chart II; the lines are, however, not drawn for the higher irregular surface of the Rocky Mountain plateau; the temperatures have not been reduced to sea level, and the isotherms, therefore, relate to the average surface of the country over which they are drawn; in mountainous regions such isotherms would be controlled largely by the topography, and it is, therefore, not practicable to present the temperature data in this manner unless a contour map on a large scale is published as a base chart.

In the table of meteorological data from voluntary observers the actual mean temperature is given for each station, and in the tables of climatological data for the regular stations of the Weather Bureau both the mean temperatures and the departures from the normal are given. In the latter table the stations are grouped by geographical districts, for each of which is given the average temperature and departure from the normal. The normal for any district or station may be found by adding the departures to the current average when the latter is below the normal and by subtracting when it is above.

For regular stations of the Weather Bureau the monthly mean temperature is the simple mean of all daily maxima and minima; for voluntary stations a variety of methods of computation is necessarily allowed, as shown by the notes appended to the table of meteorological data.

During October, 1893, the mean temperature was highest at a few stations in the extreme southern portion of Florida and in the Colorado Valley, the average being between 75 and 80. The temperature averaged between 50 and 55 on the immediate coast of Washington, Oregon, and California north of the 35th parallel; corresponding mean temperatures occurred on the Atlantic coast from Cape Breton to Long Island Sound. The average temperature was below 32 in central Manitoba and Saskatchewan.

#### DEPARTURES FROM NORMAL TEMPERATURE.

As compared with the normal for this month the mean temperature for October, 1893, was in excess over the lower Missouri and upper Mississippi valleys, the Lake region, the Middle States, New England, and the Canadian Maritime Provinces; the maximum excess was from 4 to 7 in the lower Saint Lawrence valley, New Brunswick, and Cape Breton.

The temperature was below the normal in the extreme north-west and throughout the Pacific States, the maximum deficit being about 4.5 in central Oregon and Washington, and 4.0 in Assiniboia and Manitoba. The temperature was also below the normal in the south Atlantic and Gulf states, although it was about normal at Key West and in South Carolina; the maximum deficit was about 3.1 at Little Rock, Ark.

The following table shows for certain stations, as reported by voluntary observers, (1) the normal temperature for October for a series of years; (2) the length of record during which the observations have been taken, and from which the normal has been computed; (3) the mean temperature for October, 1893; (4) the departure of the current month from the normal; (5) the extreme monthly mean for October during the period of observation and the years of occurrence:

State and station.	(1) Normal for the month of Oct.	(2) Length of record.	(3) Mean for Oct., 1893.	(4) Departure from normal.	(5) Extreme monthly means for October.			
					Highest.	Year.	Lowest.	Year.
<i>Arizona.</i>	°	Years	°	°	°		°	
Fort Apache .....	55.9	21	53.7	- 2.2	60.0	1875	50.6	1883
Fort Mohave .....	72.9	21	70.8	- 2.1	80.0	1875	68.5	1886
Whipple Barracks .....	55.0	22	50.8	- 4.2	62.2	1875	49.9	1883
<i>Arkansas.</i>								
Keesees Ferry .....	60.2	11	57.8	- 2.4	64.0	1881	56.0	1885
<i>California.</i>								
Riverside .....	63.8	11	.....	.....	67.2	1885	60.7	1886
<i>Colorado.</i>								
Las Animas .....	52.7	10	54.9	+ 2.2	57.1	1889	49.4	1883
<i>Florida.</i>								
Merritts Island .....	75.3	11	76.0	+ 0.7	79.0	1882	72.9	1891
<i>Georgia.</i>								
Forsyth .....	67.0	19	67.6	+ 0.6	75.4	1884	61.7	1885
<i>Idaho.</i>								
Boise Barracks .....	50.1	19	47.2	- 2.9	56.9	1872	44.5	1883
Fort Sherman .....	46.7	10	45.0	- 1.7	50.8	1889	41.2	1883
<i>Indiana.</i>								
Lafayette .....	52.8	11	54.3	+ 1.5	56.4	1881	47.9	1889
<i>Iowa.</i>								
Cresco .....	46.0	21	48.2	+ 2.2	54.1	1879	41.2	1873
<i>Kansas.</i>								
Eureka Ranch .....	55.6	10	53.6	- 2.0	62.9	1886	51.0	1883
Independence .....	58.5	21	61.8	+ 3.3	63.0	1881	52.2	1873
<i>Louisiana.</i>								
Grand Coteau .....	68.1	12	65.0	- 3.1	75.5	1883	63.4	1891
<i>Maine.</i>								
Orono .....	45.6	22	47.9	+ 2.3	49.7	1879	42.1	1888
<i>Maryland.</i>								
Cumberland .....	53.1	22	54.0	+ 0.9	60.0	1881	48.0	1888
<i>Michigan.</i>								
Kalamazoo .....	50.1	17	52.4	+ 2.3	54.5	1879	45.7	1887
<i>Missouri.</i>								
Sedalia .....	57.2	11	58.5	+ 1.3	61.4	1886	51.3	1883
<i>Montana.</i>								
Fort Custer .....	47.7	14	47.3	- 0.5	55.0	1891	42.2	1883
<i>Nebraska.</i>								
Fort Robinson .....	48.8	10	48.3	- 0.5	53.6	1884	41.4	1883
Genoa (near) .....	49.5	17	50.6	+ 1.1	55.9	1886	45.0	1883
<i>Nevada.</i>								
Brown .....	54.4	21	.....	.....	61.7	1875	46.4	1882
Carson City .....	48.8	16	47.8	- 1.0	55.1	1875	44.0	1883
<i>New Hampshire.</i>								
Hanover .....	45.0	22	49.1	+ 4.1	52.4	1879	40.5	1888
<i>New Mexico.</i>								
Deming .....	66.3	11	70.3	+ 4.0	72.4	1885	60.5	1892
Fort Wingate .....	52.4	22	52.7	+ 0.3	57.8	1875	47.2	1871
<i>New York.</i>								
Cooperstown .....	46.4	22	48.0	+ 1.6	53.3	1879	41.5	1888
Plattsburg Barracks .....	47.1	22	49.0	+ 1.9	53.6	1879	43.1	1888
<i>North Carolina.</i>								
Lenoir .....	56.3	22	56.6	+ 0.3	66.4	1878	48.0	1874
<i>Oklahoma.</i>								
Fort Reno .....	60.9	9	61.5	+ 0.6	65.6	1888	57.1	1887
Fort Sill .....	62.1	21	61.2	- 0.9	70.0	1874	57.7	1885
Fort Supply .....	58.6	13	57.0	- 1.6	62.2	1874	54.4	1885
<i>Oregon.</i>								
Bandon .....	52.1	9	50.7	- 1.4	55.2	1889	47.0	1886
<i>Pennsylvania.</i>								
Dyberry .....	46.3	20	48.1	+ 1.8	53.4	1879	41.3	1888
Grampian .....	47.6	22	49.5	+ 1.9	56.4	1879	43.4	1888
Wellboro .....	48.2	13	46.0	- 2.2	54.2	1881	41.2	1889
<i>South Carolina.</i>								
Statesburg .....	62.9	12	62.3	- 0.6	69.0	1881	58.7	1891
<i>South Dakota.</i>								
Fort Sully .....	49.0	22	49.0	0.0	56.0	1879	42.1	1873
<i>Texas.</i>								
Austin .....	67.6	21	70.2	+ 2.6	73.6	1883	63.0	1873
Silver Falls .....	62.2	7	63.0	+ 0.8	64.4	1890	59.7	1887
<i>Utah.</i>								
Terrace .....	52.5	17	49.5	- 3.0	67.1	1887	45.8	1878
<i>Vermont.</i>								
Stratford .....	46.6	20	48.4	+ 1.8	52.8	1879	40.6	1888

#### Departures from normal temperature—Continued.

State and station.	(1) Normal for the month of Oct.	(2) Length of record.	(3) Mean for Oct., 1893.	(4) Departure from normal.	(5) Extreme monthly means for October.			
					Highest.	Year.	Lowest.	Year.
<i>Virginia.</i>	°	Years	°	°	°		°	
Dale Enterprise .....	56.4	13	57.2	+ 0.8	61.3	1886	45.2	1890
<i>Washington.</i>								
Fort Townsend .....	50.6	17	46.4	- 4.2	54.6	1875	46.4	1893
<i>West Virginia.</i>								
Parkersburg .....	57.6	12	54.7	- 2.9	.....	.....	49.0	1888
<i>Wisconsin.</i>								
Madison .....	48.9	22	50.1	+ 1.2	58.2	1879	44.1	1887
<i>Wyoming.</i>								
Fort Washakie .....	43.6	10	43.6	0.0	47.2	1889	39.9	1881

#### TEMPERATURE, JANUARY TO OCTOBER, 1893.

For the period, January 1st to October 31st, the average temperature was about normal in the east and west Gulf states. It was below the normal by about 1.5 or less in New England, the middle Atlantic and south Atlantic states, southern Florida, the Ohio Valley and Tennessee, the lower lake region, the upper lake region, the upper Mississippi and Missouri valleys, the northern and middle slopes of the Rocky Mountains, the southern plateau, and the south Pacific coast region; it was also below the normal by 2 or 3 in the middle and northern plateau regions and the middle and north Pacific coast states. The mean temperature for this period was below the normal by 1.7 on the southern Rocky Mountain slope and 0.8 in the extreme northwest.

#### YEARS OF HIGHEST MEAN TEMPERATURE FOR OCTOBER.

The mean temperature for October, 1893, was the highest on record at the following stations, for which also the corresponding departures from the normal temperatures for October are given: Manchester, N. H., +3.4; Northfield, Vt., +3.5; Vineyard Haven, Mass., +3.3; Nantucket, Mass., +0.4; and Abilene, Tex., +1.9.

The highest mean temperature for October was noted from the north Pacific coast to the northeast slope of the Rocky Mountains in 1889; on the middle Pacific coast in 1887; in the east Gulf states in 1884; in the middle Gulf states in 1883; along the Atlantic states south of Pennsylvania in 1881; and from the lower Missouri and upper Mississippi valleys over the Ohio Valley, the Lake region, New York, and New England in 1879.

#### YEARS OF LOWEST MEAN TEMPERATURE FOR OCTOBER.

The mean temperature for October, 1893, was the lowest on record at the following stations, and the corresponding departures were as follows:

Fresno, Cal., -5.2; Eureka, Cal., -0.7; Walla Walla, Wash., -4.9; Portland, Oregon, -4.5; Fort Canby, Wash., -3.1; Tatoosh Island, Wash., -2.7.

The lowest mean temperature for October was noted generally over New York and New England in 1888; in the upper Mississippi and Red River of the North valleys and in Texas in 1887; along the south Pacific coast in 1886; from eastern Kansas to the middle Gulf coast in 1885; over the middle plateau region in 1883; from the Pacific coast between the 35th and 45th parallels to the northeast slope of the Rocky Mountains in 1881; in the Atlantic coast states south of New York in 1876; and in the middle Mississippi, lower Ohio, and lower Missouri valleys in 1873.

#### MAXIMUM TEMPERATURE.

The highest temperature reported for October by a regular station of the Weather Bureau was 98 on the 8th at Yuma, Ariz.; the other cases of maxima exceeding 90 were: Los Angeles, Cal., 91 on the 12th; Tucson, Ariz., 92 on the 8th; Dodge City, Kans., 91 on the 8th; Wichita, Kans., 91 on the



9th; Concordia, Kans., 91 on the 8th; Abilene, Tex., 94 on the 8th; San Antonio, Tex., 97 on the 1st; Palestine, Tex., 97 on the 1st; Hannibal, Mo., 93 on the 1st; Titusville, Fla., 91 on the 4th. The lowest maxima were 65 at Eastport, Me., on the 6th; 63 at Escanaba, Mich., on the 10th; 64 at Saint Vincent, Minn., on the 8th; 62 at Spokane, Wash., on the 15th; 55 at Tatoosh Island, Wash., on the 2d; 59 at Port Angeles, Wash., on the 4th.

#### MINIMUM TEMPERATURE.

Minimum temperatures of less than 15 were reported as follows: 14 at Northfield, Vt., on the 31st; 12 at Huron, S. Dak., on the 28th; 12 at Moorhead, Minn., on the 29th; 10 at Saint Vincent, Minn., on the 29th; 13 at Havre, Mont., on the 23d; 14 at Valentine, Nebr., on the 28th.

Minimum temperatures of 60 or more were reported as follows: 60, on the 14th, at Titusville, Fla.; 64, on the 31st, at Jupiter, Fla.; 68, on the 19th, at Key West, Fla.

#### DAILY AND MONTHLY RANGES OF TEMPERATURE.

The greatest daily range of temperature is given for each station in the table of climatological data for Weather Bureau stations. The extreme monthly ranges of 60 or over have been confined to South Dakota, Kansas, Iowa, the southern portions of North Dakota and Minnesota, the eastern portion of Colorado, and the northern portions of Kansas and Missouri; the maximum monthly range was 70 at North Platte, Nebr. The smallest monthly ranges have been 20 at Key West, Fla.; 26 at Jupiter, Fla.; 27 at Galveston, Tex.; 26 at Tatoosh Island, Wash.; and 27 at Fort Canby, Wash.

#### LIMITS OF FREEZING TEMPERATURE.

The southern limit of the region within which the air has had a freezing temperature at some time during the month is approximately shown by the lines on Chart VI joining the places at which minimum temperatures of 32 and of 40 occurred within the instrument shelters of the Weather Bureau; the latter minimum is usually accompanied by a more or less severe frost on the ground outside of the shelter. During October, 1893, the line of minimum 40 extended from Norfolk along the immediate coast to Savannah, thence inward through southern Alabama, Mississippi, and Louisiana to Shreveport, La., and central Texas. On the Pacific coast it extended from southern Arizona to southern California and up the western coast to N. 40°. The actual reports of frosts, as given in the next paragraph of this REVIEW, can be compared with the location of this line.

#### FROST.

The reports of frosts injurious to vegetation are as follows: 2d, Table Rock, Colo., potatoes injured. 6th and 11th, Moab, Utah, tomato vines damaged. 15th, Oxanna, Ala., vegetables killed; Meridian, Miss., vegetables killed, and slight damage to cotton in some places on high lands; Shreveport, La., sweet potato vines killed; Bee Branch, Ark., potato vines killed; Keesees Ferry, Ark., vegetation killed; Nunnely, Tenn., tender vegetation killed; Eight Mile, Mo., vines and plants killed. 16th, Montgomery, Ala., tender plants and vegetation slightly injured; Greeneville, Tenn., tender vegetation killed on lowlands; Nashville, Tenn., tender vegetation and some corn killed. 17th, Albany, N. Y., tender vegetation killed; Lynnville, Tenn., vegetation killed on low ground; Lodi, Cal., tender plants killed and potato and tomato vines injured. 18th, Cambridge, Ind., tender plants killed. 23d, Port Angeles, Wash., potato and tomato vines killed; Springbrook, Oregon, vegetables killed on low lands. 27th, Abilene, Tex., vegetables and cotton killed; Mesquite, Tex., cotton killed on low lands; Carrollton, Mo., vegetation killed. 28th-31st, South Fork, Ky., late corn and garden vegetation damaged. 29th, Newbern, Ala., corn killed on bottom lands; Nashville, Tenn., vegetation killed; Laconia, Ind., vegetation

killed; Lancaster, Wis., late vegetation killed. 30th, Providence, R. I., plants killed; Society Hill, S. C., tender vegetation killed, and some damage to corn; Little Rock, Ark., tender plants killed. 31st, Charlotte, N. C., tender vegetation killed; Pinopolis, S. C., vegetation killed; 15 miles from Augusta, Ga., cotton and potato vines killed; Athens, Ga., cotton killed; Montgomery, Ala., tender plants and vegetables damaged.

The following table shows the dates of the occurrence of the first light frost, the first heavy frost, and the first snowfall at the respective stations:

*Dates of first light and heavy frosts and snow, October, 1893.*

State and station.	First frost.			State and station.	First frost.		
	Light.	Heavy.	Snow.		Light.	Heavy.	Snow.
<i>Alabama.</i>				<i>California—Continued.</i>			
Alco.....	30	.....	.....	Lodi.....	17	.....	.....
Bermuda.....	29	.....	.....	Mokelumne Hill.....	16	.....	.....
Birmingham.....	16	.....	.....	Orangevale.....	13	17	.....
Brewton.....	14	29	.....	Palermo.....	17	.....	.....
Carrollton.....	29	31	.....	Placerville.....	.....	30	.....
Citronelle.....	16	.....	.....	Redding.....	.....	16	.....
Clanton.....	15	28	.....	Sacramento.....	17	.....	.....
Cordova.....	.....	15	.....	San Jacinto.....	30	.....	.....
Decatur.....	.....	23	.....	San Jose.....	.....	11	.....
Elba.....	15	.....	.....	Santa Cruz.....	17	.....	.....
Evergreen.....	31	.....	.....	Tulare.....	11	.....	.....
Florence.....	15	16	.....	Turlock.....	.....	17	.....
Greensboro.....	15	.....	.....	Upper Lake.....	16	.....	.....
Lynn.....	.....	15	.....	Susanville.....	.....	15	.....
Maple Grove.....	15	30	.....	Vacaville.....	16	.....	.....
Mobile.....	31	.....	.....	Wheatland.....	11	.....	.....
Montgomery.....	16	31	.....	Yuba City.....	17	.....	.....
Mount Willing.....	29	30	.....	<i>Colorado.</i>			
Newbern.....	15	29	.....	Akron.....	.....	7	.....
Newberg.....	.....	16	.....	Boulder.....	6	1	.....
Opelika.....	15	28	.....	Byers.....	.....	1	.....
Oxanna.....	15	.....	.....	Canyon.....	19	.....	.....
Pushmataha.....	15	31	.....	Cheyenne Wells.....	2	.....	.....
Rock Mills.....	15	16	.....	Colorado Springs.....	2	1	.....
Selma.....	15	31	.....	Deer Trail.....	3	1	.....
Scottsboro.....	15	30	.....	Denver.....	26	1	.....
Starlington.....	15	.....	.....	Downing.....	2	5	.....
Talladega.....	15	31	.....	Dumont.....	18	22	.....
Tallassee.....	.....	31	.....	First View.....	1	11	.....
Thomasville.....	16	.....	.....	Glen Eyrie.....	.....	1	.....
Tuscaloosa.....	16	31	.....	Gold Hill.....	1	.....	.....
Tuscumbia.....	15	.....	.....	Grand Junction.....	26	.....	.....
Union Springs.....	14	.....	.....	Hugo.....	.....	1	.....
Wilsonville.....	30	.....	.....	Husted.....	2	1	.....
<i>Arizona.</i>				Kit Carson.....	23	.....	.....
Calabasas.....	.....	1	.....	La Jara.....	.....	27	.....
Crittenden.....	2	23	.....	Lamar.....	2	.....	.....
Dudleyville.....	3	.....	.....	Las Animas.....	2	.....	.....
Flagstaff.....	.....	22	.....	Lay.....	.....	2	.....
Holbrook.....	2	.....	.....	Le Roy.....	.....	11	.....
Lochiel.....	.....	1	.....	Minneapolis.....	4	.....	.....
Payson.....	1	2	.....	Parachute.....	3	.....	.....
Saint Helenas Ranch.....	24	.....	.....	Pueblo.....	2	.....	.....
Show Low.....	.....	1	.....	Red Cliff.....	.....	1	.....
Wilgus.....	2	3	.....	River Bend.....	2	1	.....
<i>Arkansas.</i>				Saint Cloud.....	16	10	.....
Ashdown.....	15	.....	.....	Sanborn.....	21	.....	.....
Bee Branch.....	4	15	.....	San Luis.....	.....	25	.....
Brinkley.....	15	29	.....	Seibert.....	.....	11	.....
Camden.....	15	22	.....	Stamford.....	.....	1	.....
Conway.....	15	.....	.....	Table Rock.....	2	.....	.....
Corning.....	.....	15	.....	Thon.....	.....	1	.....
Dallas.....	15	.....	.....	Vilas.....	26	.....	.....
Fayetteville.....	.....	15	.....	Watkins.....	.....	10	.....
Forrest.....	15	.....	.....	Zuck.....	2	.....	.....
Fort Smith.....	.....	15	.....	<i>Connecticut.</i>			
Hamburg.....	.....	15	.....	Bridgeport.....	17	.....	.....
Keesees Ferry.....	.....	15	.....	Canton.....	.....	17	30
Kirby.....	15	.....	.....	Greenfield Hill.....	.....	17	.....
Lonoke.....	.....	15	.....	Hartford.....	.....	17	.....
Little Rock.....	13	30	.....	Lebanon.....	.....	17	.....
Malvern.....	4	.....	.....	Middletown.....	.....	17	.....
Marcella.....	22	26	.....	New Hartford.....	.....	17	.....
New Gascony.....	.....	15	.....	New Haven.....	.....	17	.....
Newport.....	.....	15	.....	New London.....	3	17	.....
Oceola.....	15	29	.....	Norwalk.....	17	30	.....
Ozark.....	15	.....	.....	South Manchester.....	.....	17	.....
Prescott.....	16	.....	.....	Stevenson.....	.....	26	.....
Rison.....	.....	15	.....	Storrs.....	.....	17	.....
Russellville.....	15	.....	.....	Thompson.....	.....	17	.....
Searcy.....	14	16	.....	Voluntown.....	.....	17	.....
Stuttgart.....	15	.....	.....	<i>Delaware.</i>			
Washington.....	14	15	.....	Dover.....	.....	17	.....
<i>California.</i>				Milford.....	.....	29	.....
Arcata.....	.....	17	.....	Millsboro.....	.....	17	.....
Cloverdale.....	17	.....	.....	Seaford.....	.....	17	.....
Edmonton.....	.....	16	.....	<i>District of Columbia.</i>			
Eureka.....	17	.....	.....	Washington.....	.....	17	.....
Evergreen.....	15	.....	.....	<i>Florida.</i>			
Florin.....	11	16	.....	Moseley Hall.....	30	.....	.....
Fresno (near).....	.....	11	.....	<i>Georgia.</i>			
Gridley.....	11	.....	.....	Adairville.....	.....	15	.....
Iowa Hill.....	16	.....	.....	Albany.....	.....	31	.....
Jolon.....	10	.....	.....	Americus.....	15	31	.....

## Dates of first light and heavy frosts and snow—Continued.

State and station.	First frost.			State and station.	First frost.		
	Light.	Heavy.	Snow.		Light.	Heavy.	Snow.
Georgia—Continued.				Kansas—Continued.			
Athens		31		Columbus	14	15	
Atlanta	15	16		Concordia		14	29
Augusta	15	31		Cunningham	14		
Brag	15			Dodge City	3	12	
Camak	16	31		Eldorado	13	24	
Camilla	15			Elk City	3		
Cebutta		15		Emporia		15	
Covington	15	31		Engelwood	12	25	
Dahlonega	15	29		Garden City	3		
Dublin		31		Grainfield	3	12	
Elberton	14	30		Grenola	3	15	
Fleming	31			Hutchinson	13	27	
Forsyth	15	31		Independence	3	15	
Grimm	15	30		Kiowa	3	27	
Hephzibah	30	31		Leavenworth		3	
Homerville	15			Lebo		15	
Lafayette	15	30		Leoti		2	
Lagrange	15			Manhattan		3	
Livingston	14	30		Mankato		29	
Louisville	13	31		Marion	13	15	
Macon	16	31		Marmaton	3	15	
Marietta	15	31		Medicine Lodge	3	20	
Marshallville	15	28		Minneapolis		13	
Milledgeville		31		Morton	6	28	
Millen	16	31		Mount Holly	13	29	
Morgan	14	30		Olathe		27	
Piscola	31			Oswego		14	
Point Peter	15			Pleasant Dale		12	
Poulan	16			Rome	3		
Reynolds	13			Sedan	14	27	
Rome	15	16		Sharon Springs		11	
Savannah	31			Topeka	14	15	
Thomasville	16			Tribune	2		
West Point	15			Utica		12	
Whitesburg		31		Wakefield	25	29	
Idaho.				Wallace			
Garden Valley			10	Wamego	3	15	
Illinois.				Washington			
Bushnell		15		Wichita	13	15	27
Cairo		15		Winona	25	26	
Chicago		16		Yates Center		3	
Dubuque		16		Kentucky.			
East Peoria		17		Bowling Green	15	29	
Galva		25		Canton		29	
Golconda		15		Carrollton		28	
Greenville		15		Cattlettsburg	16	30	
Griggsville		15		Edmonton		16	
Havana		16		Eubanks		16	
Jordans Grove		30		Franklin		15	
Lagrange		16		Greendale		16	
Mattoon		29		Greensburg		30	
Olney		15		Harrodsburg		16	
Oswego		16		Louisville		16	
Palestine		16		Middlesboro		16	
Pana		25		Mount Sterling		28	
Paris		16		Pellville		29	
Peoria		29		Russellville		16	
Rockford		24		Shelby City		16	
Sycamore		15		South Fork		28	
White Hall		15		Louisiana.			
Indiana.				Abbeville			
Ashboro		16		Alexandria	15		
Butler		16		Amite	15		
Cambridge City		18		Baton Rouge	16		
Connersville		16		Cheneyville	15		
Degonia Springs		30		Clinton	15	29	
Franklin		16		Davis	15		
Hawpach		28		Delhi	13	28	
Huntingburg		16		Emilie	15		
Jasper		16		Farmersville		15	
Jeffersonville		16		Girard	15	28	
Laconia		29		Hammond	15		
Lafayette		16		Jeanerette	13		
Madison		29		Lafayette	15		
Marengo		16		Lake Providence		15	
Markle		29		Liberty Hill	13	15	
Mount Vernon		29		Maurepas	16		
New Albany		29		Melville	29		
Princeton		16		Monroe	14	15	
Rushville		29		New Iberia	16		
Seymour		16		Opelousas	15	29	
Terre Haute		16		Oxford	13	15	
Union City		16		Paincourtville	30		
Vevay		29		Plaquemine	8		
Worthington		16		Roseland	15		
Indian Territory.				Schriever			
Kemp	13	27		Shreveport	15		
Lehigh	15	27		Thibodeaux	30		
Iowa.				Wallace			
Blakeville		29		Winnfield	15	16	
Davenport	15			Winnboro	12		
Fort Madison	15			Maine.			
Fulton	16			Bar Harbor		30	
Hopkinton	30			Belfast		19	
Indianola	14			Eastport	17	31	
Logan		29		Gardiner		17	
Kansas.				Mayfield			
Abilene		13		Portland	12	17	
Allison		13		Maryland.			
Altos	3	25		Bachmans Valley		17	
Atchison		15		Baltimore		17	
Cawker City		12		Barren Creek Springs		17	
Collyer	27			Boettcherville		29	

## Dates of first light and heavy frosts and snow—Continued.

First frost.			First frost.		
State and station.	Light.	Heavy.	State and station.	Light.	Heavy.
Maryland—Continued.			Minnesota—Continued.		
Cumberland		16	Crookston		23
Darlington		17	Duluth		24
Fallston		17	Fergus Falls		23
Fenby		30	Fort Ripley		23
Frederick		31	Granite Falls		27
Glyndon		17	Lake Winnibigoshish		23
Mount Saint Marys	17	30	Long Prairie		23
New Market		16	Maple Plain		23
Oakland		29	Milan		23
Solomons	17		Montevideo		23
Taneytown	1		New London		23
Woodstock		17	Ortonville		23
Massachusetts.			Saint Olof		23
Adams (near)		29	Sauk Center		23
Andover		17	Wadena		23
Bedford		16	Willmar		23
Boston		17	Mississippi.		
Chestnut Hill		17	Aberdeen		15
Concord		17	Agricultural College	15	29
Dudley		17	Briers		15
Fall River		17	Brookhaven		15
Fitchburg		17	Canton		15
Gilbertville		17	Columbus		15
Groton		1	Crystal Springs	13	15
Hadley		17	Duck Hill		15
Hyannis		19	Edwards		15
Leeds		17	Enterprise	14	30
Leominster		17	Fayette		15
Ludlow Center		17	French Camps		15
Mansfield		17	Greenville		16
Middleboro		17	Hattiesburg		15
Milton	16	17	Holly Springs		15
Monroe		29	Itta Bena		15
Monson	1	17	Jackson		16
New Bedford		30	Kosciusko		14
Plymouth		30	Meridian	4	15
Provincetown		30	Okaloosa		31
Randolph		17	Palo Alto		15
Roxbury		30	Pearlington		15
Somerset	11	17	Pontotoc		29
South Dennis		20	Stonington		15
Taunton		17	University	30	
Vineyard Haven	17	31	Vaiden		15
Wakefield		30	Vicksburg		15
Wellesley		31	Water Valley	14	30
Westboro		17	Waynesboro	23	
Winthrop		17	Woodville	13	
Woods Holl	30		Yazoo City	15	30
Worcester		17	Missouri.		
Michigan.			Appleton		24
Albion		16	Arthur		15
Allegan		28	Bethany		25
Alpena		14	Birch Tree		15
Bear Lake		26	Bluffton		15
Bellaire		28	Carrollton		27
Benton Harbor		28	Carthage		15
Berlin		27	Columbia		15
Bronson		28	Conception		7
Brown City		28	Cowgill		15
Calumet		26	East Lynne		15
Charlevoix		28	Edge Hill		9
Cheboygan		28	Eight Mile		15
Crystal Falls		28	Eldon		15
Detroit		28	Farmersville		15
Evart		28	Fayette		15
Fitchburg		28	Fox Creek		29
Gaylord		26	Fulton		14
Grand Haven		28	Gallatin		28
Grand Rapids	16		Gayoso		15
Harrison		28	Glasgow		15
Harrisville		28	Gordonville		29
Hastings		28	Half Way		15
Jeddo	17		Hannibal		24
Kalamazoo	30		Harrisonville		27
Lansing		28	Hastain		14
Lathrop		28	Houston		15
Lodi		28	Humansville		15
Madison		28	Kidder		15
Marshall		28	Lamonte		15
Mottville		28	La Plata		25
North Marshall		28	Lexington		15
Olivet		28	Linn Creek		15
Paris		28	Marceline		15
Parkville		28	Marshall		14
Port Huron		28	Miami		15
Rawsonville		28	Mine La Motte		15
Rockland		23	Mount Vernon		15
Saint Ignace		28	New Boston		27
Sand Beach	16		New Haven		26
Stanton		28	New Palestine		24
Sault Ste. Marie		14	Oak Ridge		15
Ypsilanti		28	Olden		29
Minnesota.			Oregon		15
Ada		23	Palmyra		15
Alexandria		23	Panacea		15
Barrett		23	Platte River		24
Beardsley		23	Saint Louis		25
Bingham Lake		27	Sarcozie		15
Bird Island		23	Sedalia		28
Blooming Prairie		27	Shelbina		15
Caledonia		28	Springfield		15
Camden		23	Steelville		15
Collegeville		23	Stellada		15



## Dates of first light and heavy frosts and snow—Continued.

State and station.	First frost.			State and station.	First frost.		
	Light.	Heavy.	Snow.		Light.	Heavy.	Snow.
<i>Missouri—Continued.</i>				<i>New York.</i>			
Unionville		19		Addison		17	28
Van Cleve		13		Albany		17	29
Vermont		15		Alfred Center			28
Vilas		3		Angelica			16
Warrenton		15		Arcade			28
Wheatland		15		Baldwinsville		1	29
<i>Nebraska.</i>				Binghamton		17	
Agee			28	Brookport			29
Ashland			29	Brookfield			16
Ashton			11	Buffalo		29	
Bassett			11	Cooperstown		1	28
Beaver City		12		Eden Center		1	30
Eriecon			11	Factoryville			29
Gering			25	Fleming			29
Haigler		2		Friendship			16
Hartington			29	Geneva			30
Harvard		28		Gloversville			29
Hay Springs			1	Hess Road Station			30
Kearney			11	Humphrey		3	16
Kimball			1	Ithaca			28
Lynch			28	Jamestown			29
Norfolk			28	Le Roy		26	30
Omaha			28	Lockport		26	
O'Neill			11	Lowville			29
Plattsmouth			29	Lyons			29
Ravenna			11	Malone			29
Santee Agency			28	New York		17	30
Stanton		12		Ogdensburg		17	
Sutton			11	Oswego			30
West Point			28	Oxford			29
Wilcox			11	Palermo			30
<i>Nevada.</i>				Perry City			16
Austin			22	Port Jervis		17	
Candelaria		11		Rochester			15
Edgewood			10	Romulus		17	29
Gold Hill			15	South Canisteo			28
Lewers Ranch			16	Stillwater		31	
Pioche			17	Wappingers Falls		17	30
South Camp			15	<i>North Carolina.</i>			
<i>New Hampshire.</i>				Asheville		15	16
Bethlehem			29	Bailey			16
Brookline			17	Bakersville		16	17
East Canterbury			17	Bryson City		14	28
Hanover		11	29	Chapel Hill		16	29
Littleton		26		Charlotte		16	31
Manchester			17	Columbus		16	29
Plymouth			17	Douglas		15	16
Sanbornton			17	Falkland		17	30
Stratford			29	Fayetteville		15	31
<i>New Jersey.</i>				Fiat Rock			16
Allaire		1	16	Goldsboro			17
Asbury Park		17	29	Greensboro		29	
Atlantic City		17	30	Henderson		16	30
Bayonne			17	Highlands			16
Belvidere			29	Horse Cove		15	16
Beverly		17	30	Lenoir		15	29
Blairstown			17	Lillington		15	30
Boonton			17	Littleton		15	29
Bridgeton			31	Louisburg		15	30
Camden		17	30	Lumberton		15	
Cape May			17	Lynn		15	29
Charlotteburg			17	Marion			16
Chester			26	May		15	30
Egg Harbor City			17	Mocksville		15	17
Elizabeth			17	Mount Airy			16
Franklinville			17	Mount Pleasant		15	30
Freehold			17	Murphy			15
Friesburg			17	Oak Ridge		15	16
Gillette			16	Pittsboro		16	30
Hightstown		17	30	Raleigh		17	30
Imlaystown			17	Rockingham		15	31
Junction			17	Roxboro		16	30
Lambertville			29	Rutherford College		16	31
Lancewood			30	Salisbury		16	30
Millville			17	Saxon		15	29
Moorestown			17	Shelby		15	30
Newark			17	Sloan		15	31
New Brunswick			17	Smithfield		16	30
Newton			17	Soapstone Mount		16	17
Ocean City			30	Southern Pines			30
Oceanic			17	Southport		30	
Paterson			17	Weldon		16	30
Pensauken			17	Willeyton		16	31
Plainfield			17	Wilmington		30	
<i>New Mexico.</i>				<i>North Dakota.</i>			
Albuquerque		2		Berlin			23
East Las Vegas		2		Bottineau			23
Gallinas Spring		2		Ellendale			23
Halls Peak		2		Forman			23
La Luz				Fort Buford		1	
Olio		26		Fort Yates			23
Santa Fe		3		Grand Forks			23
Socorro		2		Jamestown			23
Sulphur Hot Springs			22	Kelso			23
				Milton			1
				Napoleon			23
				New Salem			1
				Power			23
				Wahpeton			23
				Washburn			1
				Williamsport			23
				<i>Ohio.</i>			
				Bangorville		16	27

## Dates of first light and heavy frosts and snow—Continued.

State and station.	First frost.			State and station.	First frost.		
	Light.	Heavy.	Snow.		Light.	Heavy.	Snow.
Ohio—Continued.				Rhode Island.			
Batavia.....		15	.....	Kingston.....	16	17	.....
Bement.....			28	Lonsdale.....		30	.....
Bethany.....		16	.....	Narragansett Pier.....	16	17	.....
Binola.....		29	.....	Providence.....	17	30	.....
Bissells.....			28	South Carolina.			
Bloomington.....		16	.....	Batesburg.....	16		.....
Bucyrus.....		31	29	Blacksburg.....	15	30	.....
Cadiz.....		25	.....	Blackville.....	31		.....
Cedarville.....		31	.....	Blenheim.....	15	31	.....
Celina.....			29	Brewer Mine.....	15		.....
Cincinnati.....		16	.....	Central.....	15	29	.....
Clarksville.....		16	.....	Charleston.....	31		.....
Cleveland.....		17	29	Cheraw.....	15	30	.....
Colebrook.....		17	29	Columbia.....	29	30	.....
Columbus.....			28	Connors.....	15	31	.....
Dayton.....		29	.....	Cross Hill.....	15	31	.....
Ellsworth.....		30	.....	Darlington.....	29	31	.....
Elyria.....		17	29	Effingham.....	13	29	.....
Findlay.....			28	Flint Hill.....	17	31	.....
Fostoria.....			28	Georgetown.....	31		.....
Garrettsville.....		2	.....	Greenville.....		15	.....
Gratiot.....		29	.....	Hardeeville.....	16		.....
Green Hill.....			28	Hollands Store.....	16	31	.....
Hanging Rock.....		29	.....	Kingstree.....		31	.....
Harbor.....			30	Little Mountain.....	15	31	.....
Hillhouse.....		30	.....	Longshore.....	15	31	.....
Hillsboro.....		16	.....	Martins.....	15	30	.....
Hiram.....			28	Pinopolis.....	30	31	.....
Jacksonboro.....		16	.....	Saint Stephens.....	31		.....
Leipsie.....		28	.....	Santuck.....	15	30	.....
Logan.....		29	.....	Simpsonville.....	15	29	.....
Lordstown.....		16	.....	Statesburg.....	16	31	.....
Lowell.....			29	Tillers Ferry.....	16	31	.....
Marion.....		16	.....	Timmonsville.....	30	31	.....
McConnellsville.....			29	Trenton.....	15	31	.....
Milfordton.....		29	.....	Watts.....	17	31	.....
Millport.....			27	Yorkville.....	15	30	.....
Montpelier.....		17	28	South Dakota.			
New Alexandria.....		29	.....	Ashcroft.....		1	.....
Nelsonville.....			28	Bear Valley.....	15	1	.....
North Lewisburg.....		16	.....	Bowdle.....			23
Orangeville.....		17	.....	Castlewood.....	23		23
Pataskala.....			29	Cross.....			1
Pomeroy.....		16	29	De Smet.....	31		23
Portsmouth.....		31	.....	Faulkton.....			23
Ripley.....		16	.....	Forestburg.....	15		23
Sandusky.....		16	.....	Forest City.....	23		23
Stoutsville.....		25	.....	Frankfort.....	31		23
Tiffin.....			28	Gary.....	24		24
Toledo.....		28	28	Greenwood.....			28
Upper Sandusky.....			29	Hitchcock.....	15		23
Van Wert.....		29	.....	Hotch City.....	31		23
Warren.....		28	.....	Huron.....	23		23
Waynesville.....		16	.....	Kimball.....	16		28
Westerville.....		16	.....	Mellette.....	23		23
Weymouth.....			29	Northville.....	15		23
Youngstown.....			29	Oelrichs.....	15		25
Oklahoma.				Parker.....	15		31
Britton.....	3	26	.....	Parkston.....			27
Burnett.....		15	.....	Pierre.....	31		23
Oklahoma.....	2		28	Rapid City.....			1
Winnview.....	13		.....	Spearfish.....			1
Oregon.				Tyndall.....	15		29
Albany.....	1	23	.....	Watertown.....	16		23
Ashland.....		17	.....	Webster.....			23
Astoria.....	23		.....	Wessington Springs.....	15		28
Aurora.....		23	.....	Whitewood.....			1
Bandon.....	25		.....	Yankton.....			28
Corvallis.....	14	23	.....	Tennessee.			
Forest Grove.....	13	23	.....	Andersonville.....	15	17	.....
Grants Pass.....	13		.....	Ashwood.....	15	30	.....
Hood River.....		23	.....	Byrdstown.....	16	29	.....
Hubbard.....	21		28	Chattanooga.....	15	17	.....
Jacksonville.....	17		.....	Clarksville.....	15	29	.....
Joseph.....			8	Covington.....	15	30	.....
Mount Angel.....	17	29	.....	Florence.....	15	29	.....
Newport.....	23		.....	Franklin.....		16	.....
Pendleton.....	12	22	22	Greenville.....	16	29	.....
Portland.....	1	23	.....	Hohenwald.....		15	.....
Roseburg.....	1		.....	Jackson.....	15	16	.....
Salem.....	14		.....	Johnson City.....	23		.....
Springbrook.....	23		.....	Knoxville.....	15	29	.....
The Dalles.....	23	23	.....	Lynnville.....	15	29	.....
Toledo.....	23	25	.....	Memphis.....	15	16	.....
Vernonia.....			31	Nashville.....	15	16	.....
Pennsylvania.				Newport.....	16		.....
Aqueduct.....			30	Nunnely.....		15	.....
Easton.....		17	.....	Pikeville.....	8	15	.....
Erie.....	2	17	28	Riddleton.....	8	21	.....
Harrisburg.....	1	17	.....	Rogersville.....	15	16	.....
Le Roy.....	1	16	16	Rugby.....			23
Lock No. 4.....			28	Springdale.....			16
Mahoning.....			30	Trenton.....			15
Oil City.....			29	Tullahoma.....			15
Philadelphia.....	17	30	.....	Waynesboro.....	15	29	.....
Pittsburg.....			29	Wier.....			16
Quakertown.....		17	.....	Texas.			
Ridgway.....		29	.....	Abilene.....		27	.....
Stoyestown.....		30	.....	Arlington.....	13		27
Wellsboro.....		29	.....	Aurora.....	12		.....
Westtown.....		17	30	Belton.....	28		.....
Wilkesbarre.....			30	Brady.....	3	27	.....
				Coldwater.....	6	7	.....

## Dates of first light and heavy frosts and snow—Continued.

State and station.	First frost.			State and station.	First frost.		
	Light.	Heavy.	Snow.		Light.	Heavy.	Snow.
<b>Texas—Continued.</b>				<b>Virginia—Continued.</b>			
Dallas	27			Irwin	30		
Devine	28			Lexington	17		
Eastland	2	25		Lynchburg	16		
El Paso	3			Marion	30		
Gainesville	12	26		Nottoway	30		
Graham	13	27		Richmond	16	17	
Grapevine	13	27		Salem	16	29	
Hale City		12		Spottsville	16	17	
Hartley	2	12		Standardsville	30		
Haskell		26		Staunton	17		
Highland	3	27		Stephens City	2	28	
Longview	15			Woodstock	16		
Mesquite	3	27		Wytheville	16		
Mountain Spring	15	27		<b>Washington.</b>			
Palestine	16			Aberdeen	22		
Paris	15			Anacortes	22		
Roby	15	26		Blaine	14	31	
Silver Falls	15	25		Bridgeport	9		
Sulphur Springs		29		Centerville		31	
<b>Utah.</b>				Chelan	21		
Castle Gate			1	Colfax	23		
Heber			12	East Clallam	18		
Moab		5		Fort Canby	23	31	
<b>Vermont.</b>				Fort Townsend	19	31	
Burlington	19	29		Madrone	23	31	
Cornwall	19			Neah Bay	22		
Enosburg Falls		29		Olga	17	23	31
Hartland		29		Olympia	23		
Irassburg		29		Pine Hill	13		
Jacksonville		15		Port Angeles	23	31	
Northfield		29		Port Crescent	23	31	
Norwich		29		Pullman	13		
Stratford		16		Pysht	13	18	31
Vernon		17		Rosalia			10
Wells		11		Seattle	18	23	31
Woodstock		29		Silver Creek			31
<b>Virginia.</b>				Spokane			22
Ashland		16		Tacoma	23		
Avon		30		Tatoosh Island	23		
Bedford City	16	30		Union City	23		
Big Stone Gap	16	29		Vashon	22	22	31
Birdsneest		18		West Ferndale	13		
Blacksburg		17		<b>West Virginia.</b>			
Charlottesville	3	30		Elkhorn	16		
Christiansburg		28		Ella	31		
Dale Enterprise		17		Glenville	31		
Danville	16			Kingwood			28
Falls Church		17		Marlinton	16	17	
Fredericksburg		17		Morgantown			29
Hampton	17			New Martinsville	16	31	

## Dates of first light and heavy frosts and snow—Continued.

State and station.	First frost.			State and station.	First frost.		
	Light.	Heavy.	Snow.		Light.	Heavy.	Snow.
<b>West Virginia—Cont'd.</b>				<b>Wisconsin—Continued.</b>			
Nuttallburg		29		Green Bay			28
Parkersburg		29		Hayward			14
Pleasant Hill		28		Hill-boro			28
Point Pleasant		31		Koepnick			25
Rowlesburg		29		La Crosse			1
Weston		29		Medford			25
Wheeling		29		Milwaukee		15	
<b>Wisconsin.</b>				Osceola			14
Ashland		24		Stevens Point			28
Belleville		26		Viroqua			28
Butternut		25		Weston			25
City Point		25		<b>Wyoming.</b>			
Columbus		28		Cheyenne			1
Crandon		26		Laramie			11
Estella		24		Saratoga			1
Florence		26		Sheridan			1
Grantsburg		11		Sundance			1

## PERIODS OF HIGH TEMPERATURE.

The most interesting period of high temperature is that which includes the 8th to the 12th. During the first of these dates the maximum temperature of the month occurred in the south plateau region, the Southwest, and the central slope. On the 9th it occurred in western Missouri and along the middle and east Atlantic coasts. On the 10th the maxima of the month occurred in Wisconsin and Georgia, on the 11th in Ohio and the central Gulf states, and on the 12th over Lakes Erie and Ontario. There was, therefore, only a very general and indefinite movement of this warm wave eastward in connection with the area of clear weather.

## PERIODS OF COLD WEATHER.

The minimum temperatures for the month occurred in Colorado and Wyoming on the 26th, and in Texas and the Southwest on the 27th or 28th. This area of low temperature extended eastward, covering Illinois and the Lake region on the 30th and the entire Atlantic states on the 31st.

## PRECIPITATION (expressed in inches and hundredths).

The distribution of precipitation over the United States and Canada for October, 1893, as determined by reports from about 2,000 stations, is exhibited on Chart III. In the table of climatological data the total precipitation and the departure from the normal are given for regular stations of the Weather Bureau. The figures opposite the names of the geographical districts in the columns for precipitation and departure from the normal show, respectively, the averages for the several districts. The normal for any district may be found by adding the departure to the current mean when the precipitation is below the normal and subtracting when above.

The normal precipitation for October is generally less than for September; it is greatest along the north Pacific coast and on the east coast of southern Florida where it exceeds 6. In the Rocky Mountain and plateau regions the precipitation for October is usually less than 1, and diminishes to zero as we go southward to the lower Colorado valley, but increases rapidly as we go northwest into Oregon.

In October, 1893, the monthly precipitation was 4 to 5 on the immediate coast of extreme northern California and of Oregon, and increased toward the north to 8 and 10 in the neighborhood of Tatoosh Island, but diminished rapidly on going eastward from the coast, and was less than 1 for the interior of Washington and eastern Oregon. Little or no precipitation was reported from the interior of California, Nevada, Utah, Arizona, New Mexico, Texas, and Indian Territory, and less than 0.5 from Colorado, Kansas, Nebraska,

western Missouri, and Iowa. The heaviest rainfall occurred on the eastern coast of Florida and the eastern coast of the south Atlantic states.

## DEPARTURES FROM NORMAL PRECIPITATION.

Rainfall was in excess of the normal at Titusville, Fla., 3.0; at Mobile, Ala., 5.3; Charleston, S. C., and Savannah, Ga., 3.1; Charlotte, N. C., 4.4; Lynchburg, Va., 4.8; Cairo, Ill., 3.3; and to a less extent at most stations in the central lake region, the Ohio Valley, and the middle and south Atlantic states. Precipitation was also slightly in excess in Montana, Washington, Oregon, and neighboring Canadian stations. A slight deficiency of precipitation was reported from all other regions, the maximum deficit being in Texas, where the departures below the normal were as follows: Abilene, 3.0; Palestine, 3.6; Galveston, 4.4; Corpus Christi, 3.1.

Considered by districts the percentages of monthly precipitation for October, 1893, as compared with the normal for the month, are as follows:

In districts where the precipitation was in excess, the average percentage of the normal was as follows: northern plateau, 166; north Pacific coast, 122; eastern Gulf states, 110; middle Atlantic states, 106; lower lake region, 106; northern slope, 100; Ohio Valley and Tennessee, 93; upper lake region, 88; middle Pacific coast, 88; south Atlantic states, 80; Key West, Fla., 71; New England, 68; extreme northwest, 63; upper Mississippi valley, 55; middle plateau, 47; south



Pacific coast, 42; middle slope, 34; Missouri Valley, 21; western Gulf states, 20; southern plateau, 8; southern slope, 2.

The following table shows for certain stations, as reported by voluntary observers, (1) the average precipitation for October for a series of years; (2) the length of record during which the observations have been taken and from which the average has been computed; (3) the total precipitation for October, 1893; (4) the departure of the current month from the average; (5) and the extremes for October during the period of observation and the years of occurrence:

State and station.	(1) Average for the month of Oct.	(2) Length of record.	(3) Total for Oct., 1893.	(4) Departure from average.	(5) Extremes for October.			
					Greatest.		Least.	
					Am't.	Year.	Am't.	Year.
<i>Arizona.</i>	<i>Inches.</i>	<i>Years.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>		<i>Inches.</i>	
Fort Apache .....	1.26	17	0.04	- 1.22	4.68	1881	0.00	1878, 1891
Fort Mohave .....	0.25	21	0.02	- 0.23	2.00	1874	0.00	*
Whipple Barracks .....	0.69	22	0.15	- 0.54	1.76	1889	0.00	*
<i>Arkansas.</i>								
Keesees Ferry .....	4.05	12	0.92	- 3.13	18.11	1883	0.10	1886
<i>California.</i>								
Riverside .....	0.31	13	.....	.....	1.28	1889	0.00	1886, 1891
<i>Colorado.</i>								
Las Animas .....	0.51	12	0.02	- 0.49	1.19	1885	0.02	1893
<i>Florida.</i>								
Merritts Island .....	5.45	15	9.14	+ 3.69	11.94	1886	1.33	1889
<i>Georgia.</i>								
Forsyth .....	2.71	19	2.55	- 0.16	7.86	1879	T.	1891
<i>Idaho.</i>								
Boise Barracks .....	0.98	20	0.84	- 0.14	4.06	1883	0.02	1891
Fort Sherman .....	1.70	10	5.50	+ 3.80	5.50	1893	0.59	1882
<i>Indiana.</i>								
Lafayette .....	2.43	11	1.57	- 0.86	5.56	1883	0.73	1886
<i>Iowa.</i>								
Cresco .....	2.31	22	3.40	+ 1.09	8.06	1881	0.13	1889
<i>Kansas.</i>								
Independence .....	2.88	21	0.25	- 2.63	7.16	1883	0.19	1874
<i>Louisiana.</i>								
Grand Coteau .....	2.32	10	2.67	+ 0.35	4.98	1890	T.	1889
<i>Maine.</i>								
Orono .....	4.09	22	3.34	- 0.75	7.51	1888	1.09	1882
<i>Maryland.</i>								
Cumberland .....	2.33	22	4.37	+ 2.04	6.65	1890	0.00	1879
<i>Michigan.</i>								
Kalamazoo .....	2.74	17	3.08	+ 0.34	6.57	1881	0.31	1892
<i>Missouri.</i>								
Sedalia .....	2.82	15	0.88	- 1.94	7.07	1883	0.51	1878
<i>Montana.</i>								
Fort Custer .....	1.31	14	0.45	- 0.86	4.60	1891	0.24	1885
<i>Nebraska.</i>								
Fort Robinson .....	1.82	10	0.46	- 1.36	8.60	1887	T.	1888
Genoa (near) .....	1.60	17	0.49	- 1.11	3.48	1891	0.25	1879
<i>Nevada.</i>								
Browns .....	0.38	21	.....	.....	1.36	1884	0.00	*
Carson City .....	0.41	16	0.15	- 0.26	1.61	1882	T.	*
<i>New Hampshire.</i>								
Hanover .....	3.33	22	3.00	- 0.33	5.57	1873	0.53	1876
<i>New Mexico.</i>								
Deming .....	0.86	11	0.00	- 0.86	2.13	1887	0.00	*
<i>New York.</i>								
Fort Wingate .....	0.94	22	0.00	- 0.94	2.75	1872	0.00	*
<i>North Carolina.</i>								
Cooperstown .....	3.28	22	1.27	- 2.01	5.91	1890	1.19	1887
Plattsburg Barracks .....	2.47	22	0.85	- 1.62	5.15	1873	0.46	1879
<i>North Dakota.</i>								
Lenoir .....	3.17	22	8.30	+ 5.13	9.50	1885	T.	1892
<i>Oklahoma.</i>								
Fort Reno .....	3.72	10	0.00	- 3.72	6.82	1883	0.00	1893
Fort Sill .....	2.68	21	0.00	- 2.68	8.02	1877	0.00	1893
Fort Supply .....	1.45	13	0.00	- 1.45	4.99	1889	0.00	*
<i>Oregon.</i>								
Bandon .....	5.02	15	11.38	+ 6.36	11.80	1889	1.16	1880
<i>Pennsylvania.</i>								
Dyberry .....	3.36	22	2.17	- 1.19	7.39	1890	0.82	1892
Grampian .....	2.91	16	2.62	- 0.29	6.36	1890	0.59	1892
Wellshoro .....	3.34	14	2.88	- 0.46	7.50	1885	0.33	1892
<i>South Carolina.</i>								
Statesburg .....	2.70	12	4.68	+ 1.98	8.15	1887	0.02	1884
<i>South Dakota.</i>								
Fort Sully .....	0.52	22	3.00	+ 2.48	3.00	1893	0.02	1872
<i>Texas.</i>								
Austin .....	2.48	21	0.00	- 2.48	8.06	1871	0.00	1893
Silver Falls .....	2.43	7	0.05	- 2.38	3.63	1892	0.05	1893
<i>Utah.</i>								
Terrace .....	0.17	19	0.00	- 0.17	0.75	1889	0.00	*
<i>Vermont.</i>								
Stratford .....	3.21	20	2.65	- 0.56	6.80	1873	1.20	1882
<i>Virginia.</i>								
Dale Enterprise .....	2.94	13	6.18	+ 3.24	12.60	1885	0.19	1892
<i>Washington.</i>								
Fort Townsend .....	1.94	17	1.87	- 0.07	3.58	1875	1.00	1885
<i>West Virginia.</i>								
Parkersburg .....	2.14	8	4.48	+ 2.34	4.95	1888	0.61	1887
<i>Wisconsin.</i>								
Madison .....	2.67	22	1.85	- 0.82	9.12	1881	T.	1889
<i>Wyoming.</i>								
Fort Washakie .....	1.31	10	0.18	- 1.13	3.50	1891	0.18	1893

\* Frequently.

#### PRECIPITATION, JANUARY TO OCTOBER.

For the period January to October, 1893, inclusive, the total precipitation was in excess over the northern Pacific coast region and the northern, middle, and southern plateau regions by about 15 per cent of its normal value. Over the rest of the United States the total precipitation was deficient.

The percentages of the precipitation for the current year, as compared with the normal, were as follows, for each district:

In districts where the precipitation was in excess, the average percentage of the normal was as follows: Northern plateau, 129; north Pacific coast, 119; southern plateau, 112; middle plateau, 106.

In districts where the precipitation was deficient the percentage of the normal was as follows: Ohio Valley and Tennessee, 98; middle Atlantic states, 97; lower lake region, 94; middle Pacific coast, 92; New England, 92; south Atlantic states, 92; extreme northwest, 91; upper Mississippi valley, 89; Missouri Valley, 88; upper lake region, 88; east Gulf states, 85; southern Pacific coast, 80; northern slope, 76; southern slope, 72; west Gulf states, 69; middle slope, 62; Key West, 57.

#### YEARS OF GREATEST PRECIPITATION FOR OCTOBER.

The precipitation for the current month is the largest on record at regular stations of the Weather Bureau as follows: at Mobile, Ala., being 8.56, or 5.3 above the normal—the highest preceding was 7.32 in 1880; at Charlotte, N. C., being 8.27, or 4.4 above the normal—the highest preceding being 4.92 in 1892. In general the greatest precipitation for October was noted on the middle and south Pacific coasts in 1889; in an area extending from Maryland over eastern Tennessee and the interior of North Carolina in 1885; from the lower Missouri over the middle Mississippi and middle Ohio valleys in 1883; from the middle Missouri over the Red River of the North Valley in 1882; from the upper Mississippi valley over Lower Michigan in 1881; and from eastern Pennsylvania over eastern New York and southern New England in 1877.

#### YEARS OF LEAST PRECIPITATION FOR OCTOBER.

The precipitation for the current month is the least ever reported for October at regular stations of the Weather Bureau as follows: San Antonio, Tex., being 0.08, or 1.9 below the normal—the lowest preceding was 0.56 in 1878; similar data for other stations are given in the following table:

Station.	October, 1893.	Departure from normal.	Least.	
			Amount.	Year.
	<i>Inches.</i>	<i>Inches.</i>	<i>Inch.</i>	
Abilene, Tex. ....	0.03	-3.0	0.60	1891
Fort Stanton, N. Mex. ....	1.04	-1.5	0.12	1891
Springfield, Ill. ....	0.16	-3.3	0.80	1886
Des Moines, Iowa ....	2.22	-3.4	0.52	1889
Leavenworth, Kans. ....	0.48	-2.8	0.72	1875
Concordia, Kans. ....	0.14	-1.5	0.78	1890
Omaha, Nebr. ....	0.12	-2.5	0.34	1889
North Platte, Nebr. ....	0.05	-1.1	0.13	1878
Valentine, Nebr. ....	0.23	-1.0	0.27	1886
Huron, S. Dak. ....	0.19	-1.2	0.29	1888

In general the least precipitation for October was noted from the northeast slope of the Rocky Mountains over the Red River of the North and extreme upper Mississippi valleys in 1889; over the greater part of New York in 1882; over the greater part of Kansas, Oklahoma, and Indian Territory in 1879; and from western Pennsylvania over Maryland and Virginia, and in the lower Mississippi valley in 1874.

#### EXCESSIVE PRECIPITATION.

The following tables for October, 1893, show, by states, the number of stations reporting total precipitation to equal or

exceed 10.00 during the month; 2.50 in 24 hours; and 1.00 in 1 hour:

*Monthly precipitation to equal or exceed 10.00.*

State.	Number of stations.	State.	Number of stations.
Florida .....	2	Virginia.....	1
North Carolina .....	2	Washington.....	1
Oregon .....	2		

*Precipitation to equal or exceed 2.50 in 24 hours.*

State.	Number of stations.	Dates.	State.	Number of stations.	Dates.
Ohio .....	39	3, 13, 13-14, 14.	Kentucky.....	6	2, 2-3, 3, 14.
South Carolina.....	26	3-4, 12-13, 13, 21-22, 22, 22-23.	West Virginia...	6	13, 13-14.
North Carolina...	17	12-13, 13, 13-14, 21, 21-22, 22.	Louisiana.....	5	1-2, 5.
Alabama .....	16	1-2, 2, 2-3.	New Hampshire...	5	23-24.
Florida .....	14	2, 2-3, 11-12, 12, 12-13, 20, 24.	Pennsylvania.....	5	13-14, 22-23.
Virginia .....	14	12-13, 13, 13-14, 21-22, 22.	Wisconsin.....	5	2, 5-6, 6.
Oregon.....	13	7, 8.	Maine.....	4	23-24.
Georgia.....	11	2-3, 3, 12, 12-13.	Massachusetts...	2	23-24.
Connecticut.....	7	13-14, 14, 22-23, 23, 23-24.	Mississippi.....	2	1-2.
New Jersey.....	7	22-23, 23, 23-24, 27-28.	Rhode Island.....	2	23-24.
Indiana.....	7	2-3, 3, 13, 25.	Washington.....	2	7, 10-11.
Maryland.....	7	13, 13-14, 23.	California.....	1	8.
Illinois.....	6	2, 11-12, 12-13, 25-26.	Dist. of Columbia	1	13-14.
			Iowa.....	1	5-6.
			Minnesota.....	1	5.
			Missouri.....	1	12.
			New York.....	1	22-23.
			Texas.....	1	1-2.

*Precipitation to equal or exceed 1.00 in 1 hour.*

Louisiana.....	5	1, 5.	Iowa.....	1	1.
Florida.....	3	2, 24.	Missouri.....	1	1.
Georgia.....	1	3.	South Carolina..	1	3.

*Table of excessive precipitation, October, 1893.*

State and station.	Monthly rainfall to inches, or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
<b>Alabama.</b>	<i>Inches.</i>	<i>Inches.</i>		<i>Inches.</i>	<i>h. m.</i>	
Bermuda .....	4.00	2				
Brewton .....	5.95	2				
Claiborne Landing .....	3.40	2				
Elba .....	4.60	1-2				
Eufaula .....	2.94	2				
Evergreen .....	5.63	3				
Fort Deposit .....	3.55	1-2				
Geneva .....	3.00	2				
Healing Springs .....	2.75	2				
Mobile .....	7.47	1-2				
Mount Willing .....	3.52	2-3				
Newton .....	3.85	2				
Starlington .....	3.90	2				
Thomasville .....	2.50	2-3				
Union Springs .....	2.87	2-3				
Union Springs .....	3.25	2-3				
<b>California.</b>						
Crescent City .....	2.55	8				
<b>Connecticut.</b>						
Bridgeport .....	2.54	22-23				
Colchester .....	2.65	13-14				
Do. .....	2.50	23-24				
Greenfield Hill .....	2.93	23-24				
Lebanon .....	2.60	23-24				
North Franklin .....	2.63	23				
Storrs .....	2.63	14				
Voluntown .....	2.58	23-24				
<b>Dist. of Columbia.</b>						
Receiving Reservoir .....	2.53	13-14				
<b>Florida.</b>						
Eustis .....				1.10	1 00	2
Federal Point .....	4.12	11-12				
Gainesville .....				1.52	1 35	2
Grasmere .....	4.35	12				
Green Cove Springs .....	2.95	12				
Homeland .....	3.10	30				
Jacksonville .....	2.99	12-13				
Jupiter .....	11.72	4-35	24	2.05	1 00	24
Kissimmee .....	4.38	11-12				
Merritts Island .....	4.14	12				
Moseley Hall .....	2.65	2-3				
New Smyrna .....	10.02	4-45	12			

*Table of excessive precipitation—Continued.*

State and station.	Monthly rainfall to inches, or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
<b>Florida—Continued.</b>	<i>Inches.</i>	<i>Inches.</i>		<i>Inches.</i>	<i>h. m.</i>	
Orange City .....	4.55		12			
Pensacola .....	2.51		2			
Saint Francis Barracks .....	4.40		11-12			
Titusville .....	3.52		11-12			
<b>Georgia.</b>						
Augusta .....	2.70		12-13			
Columbus .....	2.52		2-3			
Darien .....	3.70		12-13			
Fort Gaines .....	3.10		2-3			
Hephzibah .....	2.80		12			
Louisville .....	4.02		12-13			
Lumpkin .....	2.61		2-3			
Macon .....	2.51		2-3			
Savannah .....	2.69		3	1.52	1 00	3
Do. .....	3.99		12-13			
Talbotton .....	3.20		2-3			
Way Cross .....	2.59		12-13			
<b>Illinois.</b>						
Aurora .....	2.65		2			
Cairo .....	2.67		12-13			
Golconda .....	2.55		25-26			
Jordan Grove .....	5.00		11-12			
Mascoutah .....	2.80		12			
Rockford .....	2.69		2			
<b>Indiana.</b>						
Butlerville .....	2.69		3			
Columbus .....	2.92		3			
Evansville .....	2.50		2-3			
Huntingburg .....	3.00		2-3			
Do. .....	2.75		13			
Do. .....	3.25		25			
Laconia .....	2.60		2-3			
Madison .....	2.51		2-3			
Marengo .....	4.50		2-3			
<b>Iowa.</b>						
Cresco .....	3.08		5-6			
Independence .....				1.30	1 10	1
<b>Kentucky.</b>						
Caddo .....	3.00		3			
Catlettsburg .....	2.93		14			
Louis .....	2.54		14			
Louisville .....	2.63		2-3			
Paducah .....	2.50		2-3			
Princeton .....	2.87		2			
<b>Louisiana.</b>						
Covington .....	2.50		1-2			
Grand Coteau .....	2.51		5			
Lake Charles .....				1.60	1 30	1
Do. .....				1.00	1 00	5
New Orleans .....	2.75		1-2			
Schriever .....				1.14	0 45	5
Shell Beach .....				1.40	1 00	5
Sugar Experimental Station .....	4.47		1-2	1.80	1 30	5
Thibodaux .....				1.12	1 00	5
West End .....	4.25		1-2			
<b>Maine.</b>						
Cornish .....	3.30		23-24			
Gardiner .....	2.88		23-24			
Lewiston .....	3.82		23-24			
Portland .....	3.19		23-24			
<b>Maryland.</b>						
Bachmans Valley .....	3.45		13-14			
Fallston .....	2.53		13			
Fenby .....	3.60		13-14			
Great Falls .....	2.60		13-14			
McDonogh .....	3.53		13-14			
Valley Lee .....	3.00		23			
Woodstock .....	3.60		13-14			
<b>Massachusetts.</b>						
Long Plain .....	2.99		23-24			
Mansfield .....	2.54		23-24			
<b>Michigan.</b>						
Alpena .....	2.78		13-14			
Ann Arbor .....	2.60		2-3			
Ball Mountain .....	2.74		3-4			
Benton Harbor .....	2.55		2-3			
Berlin .....	2.66		3			
Detroit .....	2.58		3-4			
Thornville .....	2.65		3			
<b>Minnesota.</b>						
Blooming Prairie .....	3.00		5			
<b>Mississippi.</b>						
Biloxi .....	8.00		1-2			
Logtown .....	5.34		1-2			
Moss Point .....	3.00		2			
<b>Missouri.</b>						
Gordonville .....	2.81		12			
Sarcoie .....				1.90	1 30	1
<b>New Hampshire.</b>						
Belmont .....	2.73		23-24			
Durham .....	3.30		23-24			
East Canterbury .....	3.02		23-24			
Sanbornton .....	2.59		23-24			
Weirs Bridge .....	2.50		23-24			
<b>New Jersey.</b>						
Hightstown .....	3.01		27-28			
Moorestown .....	2.76		27-28			
Newark .....	2.55		23-24			
Paterson .....	2.78		23-24			
Perth Amboy .....	2.50		27			



Table of excessive precipitation—Continued.

State and station.	Monthly rainfall in inches, or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
<i>New Jersey—Continued.</i>		<i>Inches.</i>	<i>Inches.</i>	<i>Inches</i>	<i>h. m.</i>	
South Orange		2.87	22-23			
Tenafly		2.74	23			
<i>New York.</i>						
New York		2.56	22-23			
<i>North Carolina.</i>						
Asheville		3.17	12-13			
Blowing Rock		4.71	12-13			
Charlotte		4.57	21-22			
Columbus		11.31	5.02	13-14		
Do.		3.41	22			
Flat Rock		4.12	13			
Greensboro.		2.50	21			
Henderson		2.80	12-13			
Lenoir		3.00	12-13			
Lewiston		5.02	21-22			
Lumberton		4.27	12-13			
Marion		3.30	13			
Do.		2.87	22			
Morganton		10.70	5.00	13		
Do.		3.00	22			
Mount Pleasant		2.58	12-13			
Rutherford College		3.31	13			
Shelby		2.50	22			
Tarboro		2.77	21-22			
Weldon		3.32	21-22			
<i>Ohio.</i>						
Akron		3.04	13-14			
Athens		4.50	13			
Bement		2.66	13-14			
Bissell		2.97	13-14			
Cadiz		3.70	13			
Cambridge		4.50	13			
Canton		3.40	13-14			
Carrollton		2.98	13-14			
Coalton		2.80	13			
Colebrook		3.48	14			
Dayton		2.54	3			
Demos		3.50	13-14			
Garrettsville		3.29	13-14			
Gratiot		3.20	13-14			
Green Hill		3.50	13			
Hanging Rock		2.50	13			
Harbor		3.39	14			
Hillhouse		5.00	13-14			
Hiram		3.25	14			
Logan		3.93	13			
Lordstown		3.47	13			
McConnellsville		3.96	13			
Marietta a		2.54	13-14			
Marietta b		2.80	13-14			
Milligan		3.56	13-14			
Millport		3.24	13			
Mountville		4.15	13-14			
Nelsonville		3.36	13			
New Alexandria		2.75	13-14			
New Comerstown		2.78	13			
Portsmouth a		3.58	13-14			
Portsmouth b		3.53	13-14			
Ridge		3.65	13			
Rittman		3.07	14			
Tiffin		2.93	3			
Vanceburg		2.50	13			
Warren		3.27	13			
Weymouth		2.88	13-14			
Zanesville		4.20	13-14			
<i>Oregon.</i>						
Aurora (near)		3.20	7			
Bandon		11.38	2.71	8		
Gardiner		3.43	8			
Glenora		16.57	3.87	7		
Hood River (near)		4.14	8			
Hubbard		3.74	7			
Langlois		2.95	8			
Mount Angel		3.11	7			
Newport		2.70	8			
Oregon City		2.75	7			
Springbrook		2.93	7			
Toledo		3.75	7			
Vernonia		2.56	7			
<i>Pennsylvania.</i>						
Beaver Dam		3.44	13-14			
Kilmer		3.15	13-14			
Le Roy		2.60	13-14			
New Castle		3.63	13-14			
Swarthmore		3.00	22-23			
<i>Rhode Island.</i>						
Providence a		2.96	23-24			
Providence c		3.06	23-24			
<i>South Carolina.</i>						
Blacksburg		2.82	21-22			
Brewer Mine		2.75	13			
Do.		3.31	22			
Charleston		2.83	3-4	1.35	0 18	3
Do.		4.52	12-13			
Connors		4.52	12-13			
Cross Hill		3.60	13			
Effingham		3.13	12-13			
Florence		2.89	12-13			
Georgetown		3.37	13			
Greenville		2.81	12-13			

Table of excessive precipitation—Continued.

State and station.	Monthly rainfall in inches, or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
<i>South Carolina—Continued.</i>						
Hardeeville	<i>Inches.</i>	<i>Inches.</i>		<i>Inches.</i>	<i>h. m.</i>	
Do.		2.62	3			
Martins		5.38	12-13			
Nichols		2.65	12-13			
Pinopolis		4.88	12-13			
Do.		2.75	3			
Rort Poyal		4.22	12-13			
Saint Georges		3.34	12-13			
Saint Stephens		3.61	12-13			
Santuck		3.16	12-13			
Simpsonville		3.75	12-13			
Society Hill		3.41	13			
Statesburg		2.73	12-13			
Trenton		2.34	12-13			
Trial		3.08	12-13			
Waterce		3.71	12-13			
Do.		2.65	3-4			
Watts		2.97	12-13			
Yorkville		3.49	12-13			
Youngs Island		3.60	22-23			
		4.48	12-13			
<i>Texas.</i>						
Llano		3.09	1-2			
<i>Virginia.</i>						
Ashland		2.69	13-14			
Avon	12.61	6.00	13-14			
Do.		3.22	21-22			
Big Stone Gap		2.90	13			
Christiansburg		3.20	12-13			
Riverton		3.60	13-14			
Salem		2.51	12-13			
Saluda		5.40	22			
Spottsville		3.39	22			
Stanardsville		3.48	13			
Staunton		2.86	13			
Stephens City		2.53	13-14			
Warsaw		3.05	23			
Woodstock		2.72	13			
Wytheville		2.95	13			
<i>Washington.</i>						
Neah Bay	11.44					
Pine Hill		3.30	7			
Pysht		2.51	10-11			
<i>West Virginia.</i>						
Bluefield		3.16	13			
Harpers Ferry		3.10	13-14			
Huntington		3.70	13			
Parkersburg		3.08	13-14			
Point Pleasant		3.20	13-14			
Sandyville		2.69	13			
<i>Wisconsin.</i>						
Ashland		3.10	6			
Estella		2.79	5-6			
Hayward		2.60	5-6			
Osceola		2.60	5-6			
Sharon		3.00	2			

Received too late for publication in September, 1893.

<i>Mississippi.</i>						
Palo Alto	2.53	25				
<i>Nebraska.</i>						
Red Cloud	2.57	29-30				
<i>North Carolina.</i>						
Marion	4.20	11				

## MAXIMUM RAINFALL IN ONE HOUR OR LESS.

The following table is a record of the heaviest rainfall during October, 1893, for periods of five and ten minutes and one hour, as reported by regular stations of the Weather Bureau furnished with self-registering gauges:

Station.	Maximum fall in—					
	5 min.	Date.	10 min.	Date.	1 hour.	Date.
	Inch.		Inch.		Inch.	
Atlanta, Ga.	0.06	13	0.08	13	0.05	3
Baltimore, Md.	0.06	13	0.08	13	0.37	13
Bismarck, N. Dak.	0.09	24	0.15	24	0.05	3
Boston, Mass.	0.09	24	0.15	24	0.43	24
Buffalo, N. Y.	0.05	3	0.10	3	0.25	3
Cincinnati, Ohio	0.05	3	0.10	3	0.25	3
Chicago, Ill.	0.15	15	0.25	15	0.29	15
Cleveland, Ohio	0.15	15	0.25	15	0.29	15
Denver, Colo.	0.20	3	0.31	3	0.05	11
Detroit, Mich.	0.03	1	0.05	1	0.82	3
Dodge City, Kans.	0.03	6	0.05	6	0.15	1
Duluth, Minn.	0.03	6	0.05	6	0.20	6
Eastport, Me.	0.08	7	0.16	7	0.43	7
Galveston, Tex.	0.13	6	0.22	6	0.35	6
Indianapolis, Ind.	0.17	2	0.24	2	0.48	2

## Maximum rainfall in one hour or less—Continued.

Station.	Maximum fall in—					
	5 min.	Date.	10 min.	Date.	1 hour.	Date.
Jacksonville, Fla. †	Inch.		Inch.		Inch.	
Jupiter, Fla.	0.06	12	0.09	12	0.27	12
Kansas City, Mo. *	0.25	24	0.45	24	2.05	24
Key West, Fla.	0.23	19	0.37	19	10.80	19
Marquette, Mich. †	0.05	12	0.06	12		
Memphis, Tenn.	0.03	6	0.05	6	0.10	6
Milwaukee, Wis.	0.07	13	0.12	13	0.45	13
Nashville, Tenn.	0.15	27	0.25	27	0.60	27
New Orleans, La. †	0.06	22	0.09	22	0.37	22
Norfolk, Va. †	0.05	7	0.10	7	0.42	7
Olympia, Wash.	0.15	7	0.22	7	0.43	7
Omaha, Nebr. *	0.03	14	0.06	14	0.27	14
Philadelphia, Pa.	0.06	23	0.12	23	0.40	24
Pittsburg †	0.06	6	0.11	6	0.35	6
Rochester, N. Y.	0.03	12	0.05	12	0.23	12
Portland, Me.	0.06	5	0.10	5	0.22	5
Portland, Oregon.	0.01	22	0.02	22	0.09	22
Saint Louis, Mo.	0.08	3	0.63	3	1.52	3
Saint Paul, Minn.	0.03	10	0.05	10	0.11	10
Salt Lake City, Utah	0.30	20	0.40	20	0.70	20
San Diego, Cal.	0.27	6	0.46	6	0.64	6
San Francisco, Cal. *	0.05	13	0.10	13	0.45	13
Savannah, Ga. †	0.10	21	0.18	21	0.43	21
Spokane, Wash.						
Tampa, Fla.						
Vicksburg, Miss.						
Washington, D. C.						
Wilmington, N. C. †						

\* Less than 0.05 in 1 hour.

† Self-register out of order.

‡ Record incomplete.

The following tables show the number of years for which monthly precipitation to equal or exceed 10.00 inches, daily precipitation to equal or exceed 2.50 inches, and hourly precipitation to equal or exceed 1.00 inch has been reported in the several states and territories for October during the last 24 years:

## Excessive monthly precipitation.

State.	No. years noted.	State.	No. years noted.
Florida.....	14	Kansas.....	1
Texas.....	10	Kentucky.....	1
North Carolina.....	8	Maine.....	1
Oregon.....	6	Mississippi.....	1
Washington.....	6	New Jersey.....	1
Georgia.....	5	Ohio.....	1
New Hampshire.....	5	Rhode Island.....	1
Louisiana.....	4	Tennessee.....	1
New York.....	4	Arizona.....	0
California.....	4	Colorado.....	0
Michigan.....	3	The Dakotas.....	0
Virginia.....	3	Delaware.....	0
Maryland.....	2	Idaho.....	0
Missouri.....	2	Minnesota.....	0
South Carolina.....	2	Montana.....	0
Massachusetts.....	2	Nebraska.....	0
Alabama.....	1	Nevada.....	0
Arkansas.....	1	Pennsylvania.....	0
Connecticut.....	1	Utah.....	0
District of Columbia.....	1	Vermont.....	0
Illinois.....	1	West Virginia.....	0
Indiana.....	1	Wisconsin.....	0
Indian Territory.....	1	Wyoming.....	0
Iowa.....	1	New Mexico.....	0

## Excessive daily precipitation (24 hours).

Florida.....	18	Ohio.....	6
North Carolina.....	16	Indian Territory.....	5
Texas.....	16	Oregon.....	5
Louisiana.....	14	Wisconsin.....	5
Georgia.....	13	Arkansas.....	4
Kansas.....	11	Tennessee.....	4
Illinois.....	11	The Dakotas.....	4
Pennsylvania.....	11	Kentucky.....	4
New York.....	11	Minnesota.....	4
South Carolina.....	10	New Hampshire.....	4
Alabama.....	9	Washington.....	4
Maryland.....	9	Indiana.....	3
Missouri.....	9	California.....	2
Rhode Island.....	9	West Virginia.....	2
Massachusetts.....	9	New Mexico.....	1
Virginia.....	9	Utah.....	1
Maine.....	8	Vermont.....	1
Connecticut.....	8	Delaware.....	1
New Jersey.....	8	Montana.....	1
Nebraska.....	7	Wyoming.....	1
Mississippi.....	7	Arizona.....	0
Iowa.....	7	Colorado.....	0
District of Columbia.....	6	Idaho.....	0
Michigan.....	6	Nevada.....	0

## Excessive hourly precipitation.

State.	No. years noted.	State.	No. years noted.
Texas.....	10	Arizona.....	0
Iowa.....	6	California.....	0
Florida.....	5	Colorado.....	0
Kansas.....	4	Delaware.....	0
North Carolina.....	4	Idaho.....	0
Illinois.....	4	The Dakotas.....	0
Louisiana.....	4	Kentucky.....	0
Nebraska.....	3	Maine.....	0
Georgia.....	3	Massachusetts.....	0
Alabama.....	2	Michigan.....	0
District of Columbia.....	2	Minnesota.....	0
Indiana.....	2	Montana.....	0
Missouri.....	2	Nevada.....	0
South Carolina.....	2	New Hampshire.....	0
Arkansas.....	1	New Mexico.....	0
Connecticut.....	1	Oregon.....	0
Indian Territory.....	1	Rhode Island.....	0
Maryland.....	1	Tennessee.....	0
Mississippi.....	1	Utah.....	0
New Jersey.....	1	Virginia.....	0
New York.....	1	Vermont.....	0
Ohio.....	1	Washington.....	0
Pennsylvania.....	1	West Virginia.....	0
Wisconsin.....	1	Wyoming.....	0

The following tables give exceptionally heavy monthly, daily, and hourly precipitation reported for October during the last 24 years:

## Monthly.

Station and state.	Am't.	Year.	Station and state.	Am't.	Year.
Reidsville, N. C.	Inches.		Mayport, Fla.	Inches.	
29.09?	1885		30.03	1880	
Sims, Cal.	28.57	1889			

## Daily (24 hours).

Station and state.	Amount.	Date.	Station and state.	Amount.	Date.
Fernandina, Fla.	Inches.		Jupiter, Fla.	Inches.	
13.14	20-21, 1882		5.95	10-11, 1892	
Brackettville, Tex.	13.08	1-2, 1881	Fort Meade, Fla.	5.75	9, 1891
Saint Augustine, Fla.	10.31	9-10, 1880	Amelia, Fla.	5.67	1, 1891
Key West, Fla.	9.24	20-21, 1883	Evergreen, Ala.	5.63	3, 1893
Newport, Fla.	8.20	8, 1876	Columbus, N. C.	5.62	13-14, 1893
Biloxi, Miss.	8.00	1-2, 1893	Logtown, Miss.	5.34	1-2, 1893
Galveston, Tex.	7.77	2, 1871	Jacksonville, Fla.	5.40	22, 1893
Mobile, Ala.	7.47	1-2, 1893	New Bedford, Mass.	5.15	1, 1890
Fort Robinson, Nebr.	7.07	23, 1887	Abbeville, La.	5.13	23-24, 1890
Birdsneast, Va.	6.85	7-8, 1891	Saluda, Va.	5.08	21, 1890
Lawrence, La.	6.60	22, 1892	Jordan, S. C.	5.02	22-23, 1890
Avon, Va.	6.00	13-14, 1893	Jordan Grove, Ill.	5.00	11-12, 1893
Gainesville, Tex.	5.98	21-22, 1891	Morgantown, N. C.	5.00	13, 1893
Brewton, Ala.	5.93	2, 1893	Hillhouse, Ohio.	5.00	13-14, 1893

## One hour and less.

Station and state.	Amount.	Time.	Date.
Savannah, Ga.	Inches.		
0.38	0.05	3	1893
Jupiter, Fla.	0.35	0.05	7, 1892
Do.	0.35	0.05	10, 1892
Savannah, Ga.	0.35	0.05	23, 1890
Key West, Fla.	0.35	0.05	9, 1891
Tampa, Fla.	0.30	0.05	20, 1893
Cleveland, Ohio.	0.30	0.05	13, 1890
Galveston, Tex.	0.30	0.05	30, 1890
Jupiter, Fla.	0.30	0.05	1, 1890
Key West, Fla.	0.30	0.05	10, 1890
New Orleans, La.	0.30	0.05	15, 1890
Washington, D. C.	0.28	0.05	19, 1891
Vicksburg, Miss.	0.27	0.05	6, 1893
Jupiter, Fla.	0.25	0.05	24, 1893
Brownsville, Tex.	1.20	0.06	23, 1884
Savannah, Ga.	0.63	0.10	3, 1893
Jupiter, Fla.	0.60	0.10	7, 1892
Charleston, S. C.	1.35	0.18	2, 1893
Fort Scott, Kans.	1.80	0.20	2, 1881
Cresco, Iowa.	1.11	0.20	10, 1878
Galveston, Tex.	2.12	0.25	30, 1877
Abilene, Tex.	1.50	0.25	24, 1885
Des Moines, Iowa.	2.30	0.30	15, 1880
Titusville, Fla.	2.60	0.50	12, 1892

## MONTHLY SNOWFALL.

The depth of snowfall during the month of October, as re-



ported by both regular and voluntary observers, is shown by the figures on Chart VI, which also gives, by the full line, the limit at which minimum temperatures of 32° F. were at any time reported at the regular Weather Bureau stations; by the dotted line is given a similar limit for 40°. These air temperatures within Weather Bureau shelters are, of course, higher than would be given by thermometers exposed in the open air. The line of 40° within a shelter usually marks the limit of frosts on the open surface of the ground.

Monthly snowfalls of 1 inch or more occurred on mountain tops of the Sierra Nevada and over the greater part of Colorado, Wyoming, Idaho, eastern Oregon, western Nebraska, North Dakota, South Dakota, Upper Michigan, and the north-western portion of New York state, and were reported as follows; in states and territories where the maximum depth was below 1 inch the station reporting the greatest is given:

*Snowfall of one inch or more, October, 1893.*

State and stations.	Inches.	State and stations.	Inches.
<b>Arizona.</b>		<b>New Hampshire.</b>	
Flagstaff.....	0.8	Bethlehem.....	Trace.
<b>California.</b>		Hanover.....	Trace.
Cisco.....	1.0	Stratford.....	Trace.
Summit.....	3.0	West Milan.....	Trace.
<b>Colorado.</b>		<b>New Jersey.</b>	
Breckenridge.....	21.5	Boonton.....	Trace.
Climax.....	30.0	Rancocas.....	Trace.
Como (near).....	3.0	Salem.....	Trace.
Deer Trail.....	3.0	<b>New Mexico.</b>	
Denver.....	5.8	Monero.....	1.0
Dumont.....	4.0	<b>New York.</b>	
Gold Hill.....	13.5	Alfred Center.....	4.0
Husted.....	1.0	Angelica.....	2.5
La Jara.....	1.0	Arcade.....	1.8
Lay.....	4.0	Baldwinsville.....	2.0
Moraine.....	5.0	Brookfield.....	1.0
Pagoda (near).....	8.0	Friendship.....	2.4
Pikes Peak.....	34.8	Humphrey.....	8.3
Red Cliff.....	16.5	Lowville.....	3.0
Rico.....	2.3	Madison Barracks.....	1.2
River Bend.....	1.0	Number Four.....	8.0
Saint Cloud.....	3.0	Oswego.....	4.0
Seibert.....	2.0	Palermo.....	1.2
Smoky Hill Mine.....	12.0	South Canisteo.....	1.9
Stamford.....	1.5	Turin.....	2.1
Steamboat Spring.....	7.0	<b>North Dakota.</b>	
Table Rock.....	4.0	Bottineau.....	1.0
Thon.....	5.5	Churchs Ferry.....	1.0
Watkins.....	2.0	Forman.....	2.0
<b>Connecticut.</b>		Fort Buford.....	2.5
Canton.....	Trace.	Fort Stevenson.....	1.0
<b>Idaho.</b>		Gallatin.....	1.0
Bonanza City.....	5.0	Kelso.....	3.0
Grangeville.....	6.0	Larimore.....	1.5
<b>Indiana.</b>		Power.....	1.5
Hawpatch.....	Trace.	Wahpeton.....	2.0
Seymour.....	Trace.	Wild Rice.....	2.0
<b>Iowa.</b>		Woodbridge.....	5.0
Logan.....	1.0	<b>Ohio.</b>	
<b>Kansas.</b>		Cleveland (V.O.).....	1.1
Concordia.....	Trace.	Wheeler.....	1.0
Wakefield.....	Trace.	<b>Oregon.</b>	
Wichita.....	Trace.	Joseph.....	8.0
<b>Maine.</b>		Siskiyou.....	1.5
Houlton.....	Trace.	<b>Pennsylvania.</b>	
Mayfield.....	Trace.	Erie.....	1.5
<b>Maryland.</b>		Smethport.....	2.0
Oakland.....	Trace.	Wellsboro.....	1.0
Sunnyside.....	Trace.	<b>South Dakota.</b>	
<b>Michigan.</b>		Ashcroft.....	2.5
Alpena.....	1.2	Bear Valley.....	4.0
Calumet.....	1.0	Cross.....	4.3
Charlevoix.....	1.0	Faulkton.....	2.2
Cheboygan.....	1.0	Forest City.....	2.0
Gaylord.....	7.5	Fort Meade.....	3.4
Lodi.....	1.0	Frankfort.....	1.5
Marquette.....	4.8	Gary.....	1.0
Rockland.....	1.0	Mellette.....	2.0
<b>Minnesota.</b>		Northville.....	2.0
Ada.....	1.5	Spearfish.....	7.0
Moorhead.....	1.1	Webster.....	1.5
Morris.....	1.0	Whitewood.....	3.5
Park Rapids.....	2.0	<b>Utah.</b>	
Saint Olaf.....	1.0	Parowan.....	0.5
Wadena.....	1.0	<b>Vermont.</b>	
<b>Missouri.</b>		Northfield.....	0.1
Platte River.....	Trace.	<b>Washington.</b>	
<b>Montana.</b>		Port Crescent.....	0.5
Fort Missoula.....	3.8	<b>West Virginia.</b>	
Hayre.....	5.1	Weston.....	Trace.
Helena.....	1.8	Wheeling.....	Trace.
Miles City.....	1.7	<b>Wisconsin.</b>	
<b>Nebraska.</b>		Crandon.....	2.0
Hay Springs.....	1.0	Florence.....	2.0
Kearney.....	1.5	Koepenick.....	1.0
West Point.....	1.0		
<b>Nevada.</b>			
Stoffel.....	0.6		

*Snowfall of one inch or more—Continued.*

State and stations.	Inches.	State and stations.	Inches.
<b>Wyoming.</b>		<b>Wyoming—Continued.</b>	
Camp Pilot Butte.....	1.5	Laramie.....	1.0
Cheyenne.....	2.0	Saratoga.....	14.3
Fort Yellowstone.....	5.9	Sundance.....	1.0
Lander.....	2.2		

*Depth of snow on ground on the 15th and at the close of the month.*

State and stations.	15th.	31st.	State and stations.	15th.	31st.
<b>Colorado.</b>			<b>Nevada.</b>		
Breckenridge.....	0.0	Trace.	Virginia City.....	0.2	0.0
Climax.....	0.0	3.0	<b>New York.</b>		
<b>Michigan.</b>			Arcade.....	0.0	Trace.
Evart.....	Trace.	0.0	Brookfield.....	0.5	0.0
Gaylord.....	4.0	Trace.	Lowville.....	0.0	2.0
Marquette.....	0.0	0.3	Palermo.....	0.0	Trace.
<b>Minnesota.</b>			South Canisteo.....	0.0	Trace.
Sauk Center.....	0.0	Trace.	Turin.....	0.0	Trace.
<b>Montana.</b>			<b>South Dakota.</b>		
Hayre.....	0.0	0.1	Ashcroft.....	0.0	1.5
Helena.....	0.0	Trace.	<b>Wisconsin.</b>		
			Crandon.....	0.0	0.5

**HAIL.**

Description of the more severe hailstorms reported for the month is given under "Local storms."

Hail was reported as follows: 1st, Texas. 2d, Idaho, Texas, and Washington. 3d, Washington. 4th, Colorado and Idaho. 5th, Missouri and Wisconsin. 6th and 7th, Washington. 9th, California, Maine, New Hampshire, and Oregon. 10th, Oregon and Washington. 11th, Kansas, Minnesota, and Wisconsin. 14th, Maryland, Ohio, and West Virginia. 15th, California and West Virginia. 17th, North Dakota. 20th, Ohio, West Virginia, and Wisconsin. 21st, South Carolina. 23d, New York. 25th, Colorado, Illinois, North Dakota, and Wisconsin. 26th, Kentucky. 27th, New York. 29th, Massachusetts. 31st, Washington.

**SLEET.**

Sleet was reported as follows: 1st, Colorado and North Dakota. 3d, Wyoming. 5th, Colorado. 10th, Nevada. 11th, Colorado, Minnesota, Nebraska, and South Dakota. 12th, Kansas and Wisconsin. 14th, Michigan, New York, and Ohio. 15th, New York. 17th, Montana. 18th, North Dakota. 22d, Nevada. 23d, Minnesota, North Dakota, and South Dakota. 25th, Colorado, Minnesota, and Texas. 26th, Texas and Wisconsin. 27th, Minnesota. 28th, Michigan, New York, Ohio, South Dakota, and West Virginia. 29th, New Hampshire, New York, Ohio, Vermont, and Wyoming. 30th, New Hampshire and Vermont. 31st, Oregon, Vermont, and Washington.

**DRY SEASONS.**

In connection with the deficits of precipitation above mentioned the following reports of droughts affecting wells, pasturage, etc., at the end of the month have been received:

**Alabama.**—Valley Head, drought still continues, many wells and springs are dry, and water for stock is scarce.

**Louisiana.**—At the close of the month all portions of the state were in need of rain; stock water is scarce; in many sections pasturage has failed entirely; fall gardening and planting are greatly retarded.

**Missouri.**—The month was very dry, stock water scarce; many localities report the wheat injured by drought.

**Tennessee.**—Fields intended for winter wheat remain unseeded, as the soil is too dry to plow, and when sown the seed germinates badly for lack of moisture; water for stock is scarce.

**Arizona, Oklahoma, Indian Territory, Kansas, Nebraska.**—The month has been very dry.

**New Mexico.**—Halls Peak, the driest October on record; Galinas Spring, very dry.

**Texas.**—Brady, drought still continues and is becoming very

severe; stock water and wells are failing and the range is almost destitute of grass. Brazoria and Burnet, the month was very dry. At Hallettsville the month was the driest on record. At Sulphur Springs water is very scarce and wells are failing for the first time in years.

## WET SEASONS.

In connection with the regions of heavy rain shown on

Chart III the following reports affecting the crops have been received:

*Oregon.*—Langlois, excessive and continuous rains damaged the late grain. At Mount Angel the month was the wettest October on record, the excess being 3.08 above the normal, and was very unfavorable to all crops.

*Washington.*—Colfax, this month is the wettest October in many years; two-thirds of the grain is ruined.

## WIND.

The prevailing winds in October, 1893, viz., those that were recorded the most frequently, are shown on Chart II by arrows flying with the wind. Northeasterly winds prevailed in the south Atlantic and Gulf states; southeasterly winds in the Ohio Valley, Lakes Michigan and Huron, Missouri, and central Texas; northwest winds in Nebraska, North and South Dakota, Manitoba, Assiniboia, and Saskatchewan; southwest and northwest winds at the Rocky Mountain and Pacific coast stations, New York, and New England.

HIGH WINDS.  
(In miles per hour.)

Wind velocities of 50 miles, or more, per hour were reported at regular stations of the Weather Bureau as follows:

2d, 72, se., at Mobile, Ala.; 66, sw., at Pensacola, Fla. 3d, 51, nw., at Huron, S. Dak. 4th, 55, ne., at Kittyhawk, N. C.; 54, n., at Hatteras, N. C. 5th, 60, nw., at Shreveport, La.; 60, s., at Fort Canby, Wash.; 56, n., at Amarillo, Tex. 6th, 60, sw., at Chicago, Ill. 7th, 70, s., at Fort Canby, Wash. 11th, 90, s., at Fort Canby, Wash.; 72, w., at Jupiter, Fla.; 70, n., at Titusville, Fla.; 61, se., at Tatoosh Island, Wash.; 60, n., at Amarillo, Tex. 12th, 60, ne., at Charleston, S. C. 13th, 94, se., at Southport, N. C.; 58, se., at Kittyhawk, N. C.; 56, se., at Wilmington, N. C.; 56, e., at Charleston, S. C.; 55, se., at Philadelphia, Pa. 14th, 63, se., at New London, Conn.; 61, sw., at Buffalo, N. Y.; 60, s., at Northfield, Vt.; 56, se., at Oswego, N. Y.; 50, se., at Woods Holl, Mass., and New Haven, Conn.; 50, nw., at Grand Haven and Sault Ste. Marie, Mich. 15th, 59, sw., at Buffalo, N. Y. 22d, 54, se., at Kittyhawk, N. C.; 23d, 80, w., at Pikes Peak, Colo.; 55, nw., at Colorado Springs, Colo. 26th, 56, s., at Chicago, Ill. 28th, 52, nw., at Cleveland, Ohio.

## LOCAL STORMS.

**1st.**—(For some account of the damage to property and loss of life by the Gulf hurricane of October 1st-3d, see "low area" No. III, p. 272.)

**2d.**—Thunderstorms prevailed in Lower Michigan, Wisconsin, and Iowa. A man and a horse were killed by lightning at Stockton, Wis.; a barn was struck by lightning and burned at Caledonia, Wis.; a house was struck by lightning at Davenport, Iowa, in the early morning and damaged to the extent of \$1,500 (estimated).

**4th.**—Heavy rains and high winds occurred along the North Carolina and Virginia coasts. The Weather Bureau observer at Norfolk, Va., reports that 2 vessels went ashore near Virginia Beach, vessels a total loss. High southeast backing to northeast winds prevailed at Kittyhawk, N. C., during the forenoon and afternoon, with a maximum velocity of 55 miles per hour; a vessel was wrecked near that point.

During a high south wind at Hatteras, N. C., 2 men were drowned in the Sound near by.

High winds and heavy surf prevailed along the Washington and Oregon coasts. A vessel was wrecked 30 miles south of Tatoosh Island, and 6 persons were drowned. The vessel, valued at \$15,000, was a total loss.

**5th.**—A violent thunderstorm passed over Shreveport, La.,

between 8.15 and 9.40 p. m. The wind reached a maximum velocity of 60 miles per hour. A house was struck by lightning, and considerable damage was done by high wind.

**6-7th.**—Severe gales prevailed over the Great Lakes and the Mississippi Valley. High winds at Toledo, Ohio, on the 6th caused the water in the river to run out to such an extent that a barge went aground; above the city the water was said to be the lowest on record.

Three schooners were reported wrecked, and a number of accidents to shipping of a minor character were reported.

**9th.**—During a heavy thunderstorm which passed over Gardiner, Me., 4 houses were struck by lightning, one in Gardiner, and 3 in adjoining towns.

**11th.**—Severe gales and heavy rain prevailed over northwest Washington. At Tatoosh Island the wind attained a maximum velocity of 61 miles per hour from the southeast, accompanied by rain and a very heavy sea swell.

The following notes are supplementary to the general report of the storm of October 11-14, p. 273:

At Saint Augustine, Fla., the waters of the Matanzas and the San Sebastian rivers were united, a phenomenon that has not occurred since the great flood of 22 years ago. The tide rose about 12 inches over the sea wall. All telegraph and telephone lines were prostrated, many houses flooded, the cypress blocks of the street pavement floated away, and railroad traffic totally suspended. The tide during this storm rose higher than any known since 1824, and as the city was not guarded by a sea wall the present high water must be considered as the highest known. At Jacksonville, Fla., a high wind prevailed, with rain, all day of the 12th, causing damage to some cottages and bringing up the water of the Saint Johns River higher than known for years.

Savannah, Ga., reported damage of a minor character, wind reached 40 miles and sea ran heaviest for years.

At Charleston, S. C., the wind reached 60 miles, but no damage done to shipping interests.

Georgetown, S. C., was probably the worst sufferer of all stations along the coast. The wind is estimated to have reached a velocity of about 90 miles from the northeast at 9 a. m. of the 13th; died to calm at 10 a. m., and rose to about 60 miles from west by 11 a. m., gradually falling as the day passed. The high tide exceeded that of the great storm of August of this year by from 10 to 28 inches, and although the reports of lives lost are somewhat conflicting a conservative estimate places the total at fifteen.

At Southport, N. C., the wind reached a maximum velocity of 94 miles from the south on 13th, wharves were damaged, and a three-masted schooner went ashore.

At Louisburg, N. C., one life was lost.

At Wilmington, N. C., a heavy gale set in early on the 13th and rain continued throughout the day, maximum velocity of wind being 56 miles. The tide was highest ever recorded, exceeding previous highest tide by 16 inches. Some vessels were lost and much damage done; all low lands submerged.

At Raleigh, N. C., large trees were uprooted and cotton damaged severely. Hatteras, N. C., reports barkentine "Ravenscraft" went ashore. At Norfolk, Va., wires blown down. At Spottsville and Ashland, Va., crops were damaged. At Washington, D. C., the wall of a church in course of erection was blown down.

In Baltimore, Md., the rain began in the forenoon continuing to fall heavily at intervals until the early morning of the 14th. The wind reached a high velocity blowing the wire of the Brush Electric Co., in contact with the wooden portion of the building and causing a loss by fire of \$125,000 and the death of two prisoners in the city jail, an adjoining building, by suffocation. Tide in harbor higher than for a number of years and many wharves and bridges were swept away. Solomons and Woodstock, Md., also report great damage to property.

At Philadelphia, Pa., the wind reached a velocity of 50 miles, with gusts of 60 miles during the afternoon of the 13th, continuing to early morning of the 14th. Some slight damage done by wind; tide unusually high.

The storm was felt at Chester, Stroudsburg, Westtown, Lewisburg, Kil-



mer, Mifflington, Bethlehem, Carlisle, Chambersburg, Reading, Huntington, Norristown, Easton, Columbia, Pine Grove, Harrisburg, West Chester, Pittsburg, and Erie, Pa., where trees were blown down, houses unroofed, telegraphic communication interrupted, and railroad traffic delayed. While the center of this storm passed nearly as far west as Pittsburg the damage along the New Jersey coast was much greater than might have been expected. Several branch lines of the West Jersey Railroad were washed out, telegraph wires were blown down, and many small vessels were washed ashore.

The storm in New York state began about midnight of the 13th and did little damage except in the western portion and on the Lakes. On Lake Erie, off Dunkirk, the "Dean Richmond" foundered with 18 persons. Smaller vessels were reported as being wrecked all along the coast. The total known loss on the Lakes is 13 vessels, 54 lives, and \$676,000; this is the greatest loss ever known in proportion to the number of vessels out. At Manistique, Mich., a raft of logs valued at \$50,000 was lost. At New London, Conn., the wind reached a maximum velocity of 63 miles at 2.23 a. m., the 14th, all boats from New York delayed, and Light Ship "Martha Emma" wrecked. At New Haven, Conn., the wind reached 50 miles. Telephone lines over Vermont, near Montpelier, were damaged.

In Massachusetts the storm visited North Billerica, Hadley, Mansfield, and Boston, but no greater damage done than uprooting trees. The gales attending this storm were felt as far east as Portland, Me., and west as far as Duluth, Minn., during the 15th, as the storm center passed off in the direction of Labrador.

**17th.**—Hail fell at Fort Buford, N. Dak., at intervals,

from noon until 2.30 p. m. Twenty miles to the southwest, in Montana, a small number of cattle were killed by lightning.

**20th.**—During a severe thunderstorm near Uniontown, Pa., a large mill was struck by lightning; estimated loss about \$5,000. Four sheep were killed by lightning at Tiffin, Ohio.

**24th.**—A heavy gale prevailed on Lakes Superior, Huron, and Erie, and stopped navigation at the Straits of Mackinac. A schooner was wrecked 7 miles from Grand Island in Lake Superior. The crew were rescued, but the vessel, valued at \$25,000, was a total loss. A number of other accidents occurred. A report from Los Angeles, Cal., states that the heavy rains of the past two days, in the San Bernardino and Santa Ana valleys have damaged raisins and grains.

**28th.**—Severe gales prevailed over the Lake region. On Lake Superior the gale was accompanied by a heavy fall of snow, and snow squalls marked its progress across lower Lake Michigan, upper Lake Huron, and Georgian Bay. A number of wrecks were reported.

**29th.**—At Palermo, N. Y., a severe storm blew down buildings.

### INLAND NAVIGATION.

#### STAGE OF WATER IN RIVERS.

The following table shows the danger-points at the various river stations; the highest and lowest stages for the month, with the dates of occurrence; and the monthly ranges:

*Heights of rivers above low-water mark, October, 1893.*

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Height.	Date.	Height.	Date.	
<i>Red River.</i>	<i>Feet.</i>	<i>Feet.</i>		<i>Feet.</i>		<i>Feet.</i>
Shreveport, La. ....	29.2	5.4	10	—2.6	1, 2	8.0
<i>Arkansas River.</i>						
Fort Smith, Ark. ....	22.0	12.0	4	—1.0	25, 28-31	13.0
Little Rock, Ark. ....	23.0	13.0	6	3.5	29, 31	9.5
<i>Missouri River.</i>						
Fort Buford, N. Dak. ....	25.0	7.3	17	6.3	1, 2	1.0
Bismarck, N. Dak. ....	75.0	2.7	23, 30	2.1	1-4, 17, 18	0.6
Pierre, S. Dak. ....	13.0	—3.8	3, 7, 11-14	—4.0	5, 6, 20-27	0.2
Sioux City, Iowa ....	18.7	6.1	22-31	5.5	1, 4-8	0.6
Omaha, Nebr. ....	18.0					
Kansas City, Mo. ....	21.0	7.3	5	5.4	17-19	1.9
<i>Mississippi River.</i>						
Saint Paul, Minn. ....	14.0	3.1	7, 8	2.7	4	0.4
La Crosse, Wis. ....	10.0	3.1	16	2.1	1-3	1.0
Dubuque, Iowa ....	16.0	3.1	27	2.0	1, 2	1.1
Davenport, Iowa ....	15.0	2.0	29	1.2	1-4	0.8
Keokuk, Iowa ....	14.0	1.4	11, 19, 24-26	0.7	1	0.7
Hannibal, Mo. ....	17.0	1.9	23-25, 31	1.3	1, 2	0.6
Saint Louis, Mo. ....	30.0	4.2	7, 11-13	3.3	31	0.9
Cairo, Ill. ....	40.0	10.3	26	5.0	6-8, 22	5.3
Memphis, Tenn. ....	33.0	5.8	28	2.7	9, 10, 24	3.1
Vicksburg, Miss. ....	41.0	4.0	11	0.3	29	3.7
New Orleans, La. ....	13.0	4.9	2	2.8	26	2.1
<i>Ohio River.</i>						
Parkersburg, W. Va. ....	38.0	9.0	15	1.2	1, 2, 13	7.8
Cincinnati, Ohio ....	45.0	19.5	18	5.0	3	14.5
Louisville, Ky. ....	24.0	8.0	20	3.0	1	5.0
<i>Cumberland River.</i>						
Nashville, Tenn. ....	40.0	3.2	14	0.8	31	2.4
<i>Tennessee River.</i>						
Chattanooga, Tenn. ....	33.0	9.6	17	1.7	16	7.9
Knoxville, Tenn. ....	29.0					
<i>Monongahela River.</i>						
Pittsburg, Pa. ....	22.0	6.8	16	5.3	20	1.5
<i>Savannah River.</i>						
Augusta, Ga. ....	32.6	18.8	14	6.0	31	12.8

#### Heights of rivers—Continued.

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Height.	Date.	Height.	Date.	
<i>Willamette River.</i>	<i>Feet.</i>	<i>Feet.</i>		<i>Feet.</i>		<i>Feet.</i>
Portland, Oregon ....	15.0	9.8	9, 10, 12	2.0	3	7.8
<i>Susquehanna River.</i>						
Harrisburg, Pa. ....	17.0	5.3	16	1.2	13	4.1
<i>Alabama River.</i>						
Montgomery, Ala. ....	48.0	3.9	5	0.1	31	3.8
<i>James River.</i>						
Lynchburg, Va. ....	18.0	7.3	15	0.8	1, 2	6.5
<i>Sacramento River.</i>						
Red Bluff, Cal. ....	22.0					
Sacramento, Cal. ....	25.0	8.5	13	7.7	6-9, 30, 31	0.8
<i>Des Moines River.</i>						
Des Moines, Iowa ....	19.0	3.2	27-31	2.7	9-24	0.5

#### FLOODS.

The column giving the highest stages of water during October shows that none of the rivers there mentioned rose to the danger point during this month; the following reports as to other rivers have been received:

**New Mexico.**—The Hondo River rose on the 5th and 6th 8 feet higher than was ever known before, and considerable damage was done.

**South Carolina.**—The Wateree River rose from the 22d-24th, reaching 31 feet at Camden bridge, being the highest rise since 1886.

**Virginia.**—On the 15th and again on the 23d the James River overflowed its banks at Irwin.

#### CLOSING OF NAVIGATION.

Lakes and rivers continued open to navigation during October, excepting local interruptions, due to low water in the upper Missouri and Mississippi rivers.

### ATMOSPHERIC ELECTRICITY.

#### THUNDERSTORMS AND AURORAS.

The following table shows in detail for October, 1893, (1) the number of stations from which meteorological reports

were received; (2) the number of such stations reporting thunderstorms (T) and auroras (A), respectively, in each state and on each day of the month on which the phenomena were observed:

## Thunderstorms and auroras, October, 1893.

States.	No. of stations.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.	31.	Total.		
Alabama.....	53	T. A. T.	3	1			1																										4	T. A. T.	
Arizona.....	44	T. A. T.												2	1							1											4	T. A. T.	
Arkansas.....	41	T. A. T.	3			7						2													4	6							22	T. A. T.	
California.....	291	T. A. T.								3																								3	T. A. T.
Colorado.....	77	T. A. T.	1		1															3		1			1								7	T. A. T.	
Connecticut.....	24	T. A. T.																											1				1	T. A. T.	
Delaware.....	5	T. A. T.																										1	1				2	T. A. T.	
District of Columbia.....	4	T. A. T.												1																				1	T. A. T.
Florida.....	35	T. A. T.	3	7	3	2						1	1							1	1	1	1		2				1			2	26	T. A. T.	
Georgia.....	66	T. A. T.			1																													1	T. A. T.
Idaho.....	12	T. A. T.																																1	T. A. T.
Illinois.....	52	T. A. T.	2	12			5	3					3	2							3					4	3							37	T. A. T.
Indiana.....	40	T. A. T.		4	2		1																											17	T. A. T.
Indian Territory.....	4	T. A. T.	1																															2	T. A. T.
Iowa.....	76	T. A. T.	13	8		1	14	7					9	4	1						1						4	1	2					66	T. A. T.
Kansas.....	70	T. A. T.	2	1							1																							5	T. A. T.
Kentucky.....	30	T. A. T.		1																		2				1	3	2						9	T. A. T.
Louisiana.....	47	T. A. T.	2	2			8	1					1																					17	T. A. T.
Maine.....	19	T. A. T.										11																						11	T. A. T.
Maryland.....	26	T. A. T.		2			3					1																	3	1		1		6	T. A. T.
Massachusetts.....	84	T. A. T.		3			1				3		2	1									1											11	T. A. T.
Michigan.....	70	T. A. T.		3	1					1		5	2			1																		15	T. A. T.
Minnesota.....	67	T. A. T.	1				2				1	1																						10	T. A. T.
Mississippi.....	46	T. A. T.	3	1		1	7	3	1		1	7	1											6										31	T. A. T.
Missouri.....	97	T. A. T.	1				2	3				3	1	3	1	2																		6	T. A. T.
Montana.....	7	T. A. T.	15	6	2		30	1					7	4							1						5	2						64	T. A. T.
Nebraska.....	67	T. A. T.																																1	T. A. T.
Nevada.....	47	T. A. T.										2																						3	T. A. T.
New Hampshire.....	31	T. A. T.																																2	T. A. T.
New Jersey.....	57	T. A. T.																																5	T. A. T.
New Mexico.....	22	T. A. T.																																7	T. A. T.
New York.....	77	T. A. T.																																1	T. A. T.
North Carolina.....	57	T. A. T.	3	4	1		7				1	4	3	2	3										4									34	T. A. T.
North Dakota.....	33	T. A. T.																																3	T. A. T.
Ohio.....	127	T. A. T.		2			4		1	1	5	1	3			5	1																	25	T. A. T.
Oklahoma.....	14	T. A. T.	1																															2	T. A. T.
Oregon.....	65	T. A. T.				1						3																						4	T. A. T.
Pennsylvania.....	84	T. A. T.																								</									



## THUNDERSTORMS.

Description of the more severe thunderstorms reported for the month is given under "Local storms."

The dates on which reports of thunderstorms were least numerous over the country, taken as a whole, were: none on the 8th and 15th; 1 on the 16th, 18th, and 31st; 3 on the 17th and 30th.

The dates on which reports were most numerous were: 72 on the 2d, and 71 on the 5th.

The states from which reports were least numerous were: California, North Dakota, Pennsylvania, Utah, and Vermont, 3; Delaware, Indian Territory, Nebraska, Nevada, 2; Connecticut, District of Columbia, Georgia, Massachusetts, South Dakota, 1; Idaho, Montana, New Mexico, Rhode Island, Wyoming, Oklahoma, 0.

The detailed distribution of reports of thunderstorms is shown in the accompanying table for each date and state. The left-hand column of this table shows the number of stations from which meteorological reports have been received from each state, but it is not certain that all these observers have been equally careful to record all the auroras and thunderstorms that have occurred; indeed it is quite probable that many of them pay special attention to these phenomena while others neglect them. It would be improper to make very positive statements as to relative frequency of thunderstorms and auroras for each portion of the United States until there is more uniformity in the degree of attention paid by the observers. Observers will confer a favor on the students of this branch of meteorology if, while making an occasional note of a severe thunderstorm or a bright aurora, they will also state whether they have uniformly looked for these phenomena and whether the absence of a record on any date, or better still the word "none," indicates that no aurora or thunderstorm occurred within their horizon. The editor hopes in an early number of this WEATHER REVIEW to substitute for the total numbers of stations here given, the numbers of those observers who send in complete records of the occurrence of thunderstorms and auroras. When this is done it will be possible to give more accurately the relative frequency of thunderstorms for each state and month. So far as the data in the accompanying table warrants any statement it would seem that the number of thunderstorms per station per month has been as follows: Florida, 0.8; Illinois, 0.7; Iowa, 0.9; Missouri, 0.7; Ohio, 1.0; Wisconsin, 0.8. The relatively high percentage for Ohio may be partly due to the special care of the observers.

## AURORAS.

The detailed distribution of auroras, as far as they have been reported, is shown in the accompanying table for each date and state, and the remarks just made with regard to reports of thunderstorms will apply equally to those of auroras. It is considered very desirable that the occurrence of auroras should be watched for by every observer at the ordinary hours of evening observation, and as much more frequently during the night as possible. It is certain that many of the observers whose monthly reports show no auroras have generally omitted to look for them; it will contribute greatly to the accuracy of all studies into the distribution of auroras if those who do not specially look for them, and who, therefore, cannot give positive testimony as to their presence or absence, will use the word "Blank" or a dash (—) to indicate this fact, so that the monthly record from such a station will read about as follows:

"Auroras actually seen on three evenings and one early morning; certainly no auroras on five evenings; six evenings when clouds, haze, moonlight, or city illuminations obscured any aurora that might have been present; seventeen evenings blank, viz., without special observation."

The dates of auroras as given by the observers should uni-

formly refer to the evening of the civil date; auroras observed after midnight should be distinctively marked, *e. g.*, "On the 14th, a. m.;" the simple record "14th" would otherwise be understood to mean the "14th p. m.;" the record should not read "October 15th, aurora observed last night," but rather "October 15th, aurora observed this morning early," or "October 14th, aurora this evening," so that in all cases there may be no doubt as to the civil date of the morning or evening on which the aurora occurred.

So far as can be gathered from the data in the accompanying table the evenings on which fewest auroras were reported were, none on October 19th, 23d, 27th; one on October 3d, 18th, 20th, 21st, 22d, 24th, 26th, 28th. The observation of these isolated or sporadic auroras is very desirable, as the study of such cases seems likely to be especially instructive as to the causes and conditions of the phenomenon.

The moon was full on October 24th and 25th, and faint auroras were therefore difficult to observe from the 20th to the 28th; observers should be especially watchful on moonlight nights, and if they have reason to think that on any special occasion an aurora of ordinary intensity may have been hidden by the moonlight or the bright illumination of the city, they may count these nights in with the hazy and cloudy nights.

Omitting the moonlight evenings, 20–28th, inclusive, the tabulated data show that on the remaining 22 evenings there were 148 reports of observed auroras, or an average of 6.8 per day. The days whose reports are decidedly above this average are 20 on the 2d; 21 on the 5th; 17 on the 9th; 16 on the 11th; and 11 on the 14th. The states from which the reports of auroras were most numerous during the month were: Wisconsin, 15; North Dakota, 25; New York, 34; Minnesota, 18; Michigan, 10; Massachusetts, 11.

The number of evenings on which auroras were reported in the respective states is as follows: on one evening in Connecticut, Illinois, Indiana, Missouri, New Jersey, and Wyoming; on 2 evenings in Iowa, Nebraska, Ohio, South Dakota; on 3 evenings in Montana and Washington; on 5 evenings in New Hampshire; on 6 in Maine, Massachusetts, and Vermont; on 8 in Michigan; on 9 in Wisconsin; 10 in North Dakota; 11 in Minnesota; 14 in New York.

The relative frequency of auroras, or the number per station per month, was about as follows: North Dakota, 0.8; Vermont, 0.7; New York, 0.4; Wisconsin and Minnesota, 0.3; Massachusetts, 0.1.

The relation of the auroras to thunderstorms continues as stated by the editor in connection with the aurora of February, 1872, and in the MONTHLY WEATHER REVIEW for 1874, and in his report on the aurora of April 7th of that year, viz., that the aurora is most frequent in the northern part of the country when thunderstorms are more frequent to the southward; an apparent exception to this rule would seem to have occurred on the 1st of October when the auroras were too few, and on the 14th when they were too numerous, as compared with the number of thunderstorms; such exceptions may show the necessity of modifying the rule when the reports of thunderstorms and auroras have been more thoroughly systematized. As stated at that time, the aurora is an electrical discharge between masses of air rather than between the air and the ground, although sometimes the latter may also occur in high northern latitudes; it is usually confined to a widespread horizontal area at a very moderate height above the earth as compared with the great heights that have been usually attributed to it; the layer in which it occurs apparently represents the boundary region between a lower layer of cold, dry air, and an upper layer of moister air that is overflowing; these conditions are such as prevail in the northern quadrant of an area of low pressure or the southern edge of a high area, at least in latitudes 40° to

60° and east of the Rocky Mountains. The lightning discharge between clouds at low altitudes or between them and the earth requiring, as it does, higher temperatures, more aqueous vapor, and more rapidly ascending currents, is characteristic of the areas of low pressure, and especially of the quadrant of southerly winds, as was then pointed out; while auroras, requiring lower temperature, less vapor, and probably spiculae of ice such as attend the formation of snow, are characteristic of the upper layers over the region intermediate between the areas of lowest and highest pressures, and where the ascending air of the low pressures is spreading horizontally above while the descending air of the areas of high pressure is spreading horizontally below.

The meteorological conditions necessary to the production of the auroral light may be either widespread or local. The principal condition seems to be the presence of a layer of air in which moisture is condensing into minute spiculae of ice; this condition prevails over the broad zones around the earth within 30° of the north and south poles throughout the greater portion of the year, and it may possibly prevail in the upper atmosphere throughout the year much nearer the equator; this condition also prevails especially on the northern side of the areas of low pressure, or storm centers, and therefore on the easterly quadrant of the areas of high pressure. But notwithstanding this favorable meteorological condition, there can be no aurora without a special discharge of electricity.

The ultimate origin of electrical disturbance may be either cosmical or terrestrial. If the former, then auroras are subject to periods of 1, 11, or 55 years; but if the latter, and especially in so far as this disturbance is piezo-electrical, there will be lunar and solar tidal periods, and there may also be localities of special frequency, such as the auroral zone in northern latitude 55° to 70°. It is thus plain that the aurora depends on the one hand on the condition of the atmosphere and on the other hand on the condition of the interior of the earth and the sun. When an electrical disturbance from the sun, or from the interior of the earth, reaches the earth's atmosphere it will produce an auroral light in those portions of the atmosphere whose conditions are favorable thereto, but not otherwise. The two conditions must combine in order to produce the auroral effect.

#### EARTH CURRENTS AND MAGNETIC STORMS.

The electrical disturbances known as "earth currents" in telegraphy and "magnetic storms" in terrestrial magnetism, are a part of the same system of atmospheric phenomena. Reports of earth currents and magnetic storms have not been received during October, but will be included in future numbers of this REVIEW if any observers report upon these subjects to the Weather Bureau, as it is desirable that the REVIEW should deal comprehensively with all matters bearing on the weather of the month.

### STATE WEATHER SERVICES.

[Temperature in degrees Fahrenheit; precipitation, including melted snow, in inches and hundredths.]

The following extracts and summaries are republished from reports for October, 1893, of the directors of the various state weather services:

#### ALABAMA.

*Temperature.*—The mean was 1.5 below the normal; maximum, 95, at Eufaula, 8th; minimum, 22, at Decatur, 31st; greatest monthly range, 64, at Newburg; least monthly range, 36, at Birmingham.

*Precipitation.*—The average was 0.18 below the normal; greatest monthly, 8.56, at Mobile; least monthly, 0.10, at Clanton.

*Wind.*—Prevailing direction, north.—W. M. Dudley, Observer, Weather Bureau, Montgomery, director.

#### ARIZONA.

*Temperature.*—Maximum, 101, at Fort Mohave, 14th; minimum, 23, at Flagstaff, 2d; greatest monthly range, 63, at San Carlos; least monthly range, 39, at Lochiel.

*Precipitation.*—Greatest monthly, 0.40, at Buckeye and Payson; least monthly, 0.00, at several stations.

*Wind.*—Prevailing direction, southwest.—W. Burrows, Observer, Weather Bureau, Tucson, director.

#### ARKANSAS.

*Temperature.*—The mean was 0.8 above the normal; maximum, 99, at Rison, 1st; minimum, 23, at Keesees Ferry, 29th; greatest monthly range, 69, at Rison; least monthly range, 40, at Mount Nebo.

*Precipitation.*—The average was 0.92 below the normal; greatest monthly, 3.43, at Corning; least monthly, 0.25, at Arkansas City and Prescott.

*Wind.*—Prevailing direction, south.—F. H. Clarke, Local Forecast Official, Weather Bureau, Little Rock, director.

#### CALIFORNIA.

*Temperature.*—The mean was 1.0 below the normal; maximum, 102, at Salton, Indio, and Volcano Springs, 8th; minimum, 20, at Boca and Cisco, 16th; greatest monthly range, 68, at Tulare; least monthly range, 25, at Point Lobos.

*Precipitation.*—The average was 0.80 below the normal; greatest monthly, 6.22, at Crescent City; least monthly, 0.00, at a number of stations.

*Wind.*—Prevailing direction, west.—J. A. Barwick, Observer, Weather Bureau, Sacramento, director.

#### COLORADO.

*Temperature.*—The mean was 1.0 below the normal; maximum, 90, at Lamar, 9th, and Minneapolis, 7th; minimum, -2, at Pikes Peak, 26th.

*Precipitation.*—The average was 0.20 below the normal; greatest monthly, 4.10, at Pikes Peak; least monthly, 0.00, at several stations.

*Wind.*—Prevailing direction, west.—J. J. Gilligan, Observer, Weather Bureau, Denver, director.

#### FLORIDA.

*Temperature.*—Maximum, 95, at Plant City, 2d; minimum, 41, at Moseley

Hall, 31st; greatest monthly range, 48, at Archer; least monthly range, 20, at Key West.

*Precipitation.*—Greatest monthly, 11.72, at Jupiter; least monthly, 0.94, at Brookville.

*Wind.*—Prevailing direction, northeast.—E. R. Demain, Observer, Weather Bureau, Jacksonville, director.

#### GEORGIA.

*Temperature.*—Maximum, 95, at Darien, 3d; minimum, 24, at Clayton and Lafayette, 31st; greatest monthly range, 61, at Ramsey; least monthly range, 36, at Dublin.

*Precipitation.*—Greatest monthly, 6.91, at Savannah; least monthly, 0.30, at Piscola.

*Wind.*—Prevailing direction, northwest.—Park Morrill, Local Forecast Official, Weather Bureau, Atlanta, director.

#### IDAHO.

*Temperature.*—Maximum, 80, at Oakley, 8th; minimum, 3, at Martin, 30th; greatest monthly range, 62, at Bonanza City and Martin; least monthly range, 37, at Fort Sherman.

*Precipitation.*—Greatest monthly, 5.52, at Grangeville; least monthly, 0.02, at Martin.

*Wind.*—Prevailing direction, southwest.—J. H. Smith, Observer, Weather Bureau, Idaho Falls, director.

#### ILLINOIS.

*Temperature.*—The mean was 1.0 above the normal; maximum, 92, at Greenville, 9th; minimum, 15, at Dixon and Philo, 30th, and at Aurora, 31st.

*Precipitation.*—The average was 1.54 below the normal; greatest monthly, 6.55, at Jordans Grove; least monthly, trace, at Bushnell.

*Wind.*—Prevailing direction, south.—John Craig, Observer, Weather Bureau, Springfield, director.

#### INDIANA.

*Temperature.*—The mean was 1.2 above the normal; maximum, 86, at Bedford, 13th, at Union City, 10th, and at Vevay, 11th; minimum, 17, at Lafayette, 30th; greatest monthly range, 68, at Lafayette; least monthly range, 52, at New Albany and Columbia City.

*Precipitation.*—The average was 0.79 above the normal; greatest monthly, 6.18, at Bedford; least monthly, 1.57, at Lafayette.

*Wind.*—Prevailing direction, southeast.—Prof. H. A. Huston, Lafayette, director; C. F. R. Wappenhans, Local Forecast Official, Weather Bureau, assistant.

#### IOWA WEATHER AND CROP SERVICE.

*Temperature.*—Maximum, 94, at Glenwood, 10th; minimum, 10, at Emmetsburg, 29th; greatest monthly range, 75, at Emmetsburg; least monthly range, 50, at Hopkinton.



**Precipitation.**—Greatest monthly, 4.56, at Blakeville; least monthly, 0.02, at Algona.—*J. R. Sage, Des Moines, director; G. M. Chappel, Local Forecast Official, Weather Bureau, assistant.*

## KANSAS.

**Temperature.**—The mean was 0.9 above the normal; maximum, 97, at Sterling, 9th; minimum, 18, at Mankato, 29th; greatest monthly range, 71, at Manhattan and Oswego; least monthly range, 54, at Emporia.

**Precipitation.**—The average was 1.52 below the normal; greatest monthly, 1.82, at Oswego; least monthly, 0.00, at McPherson, Rome, and Wallace.

**Wind.**—Prevailing direction, south.—*T. B. Jennings, Observer, Weather Bureau, Topeka, director.*

## KENTUCKY.

**Temperature.**—The mean was 2.9 above the normal; maximum, 90, at Harrodsburg, 10th and 11th; minimum, 19, at Eubank, 30th and 31st; greatest monthly range, 70, at Harrodsburg; least monthly range, 33, at Hendricks.

**Precipitation.**—The average was 1.90 above the normal; greatest monthly, 7.38, at Catlettsburg; least monthly, 1.50, at Matlock.

**Wind.**—Prevailing direction, southwest.—*Frank Burke, Local Forecast Official, Weather Bureau, Louisville, director.*

## LOUISIANA.

**Temperature.**—The mean was 1.6 below the normal; maximum, 98, at Cameron, 2d; minimum, 29, at Covington, 15th and 16th.

**Precipitation.**—The average was 1.30 below the normal; greatest monthly, 6.57, at Sugar Experiment Station; least monthly, 0.15, at Melville.

**Wind.**—Prevailing direction, north.—*R. E. Kerkam, Local Forecast Official, Weather Bureau, New Orleans, director.*

## MARYLAND.

**Temperature.**—Maximum, 88, at Cambridge, 3d; minimum, 13, at Sunnyside, 31st; greatest monthly range, 68, at Sunnyside; least monthly range, 47, at Solomons.

**Precipitation.**—Greatest monthly, 6.40, at Valley Lee; least monthly, 2.59, at Darlington.

**Wind.**—Prevailing directions, northwest and southeast.—*Dr. William B. Clark, Johns Hopkins University, Baltimore, director; Prof. Milton Whitney, Maryland Agricultural College, secretary and treasurer; C. P. Cronk, Observer, Weather Bureau, in charge.*

## MICHIGAN.

**Temperature.**—The mean was 0.9 above the normal; maximum, 90, at Climax, 12th; minimum, 16, at Crystal Falls, 30th; greatest monthly range, 68, at Fitchburg; least monthly range, 40, at Arbela.

**Precipitation.**—The average was 0.62 above the normal; greatest monthly, 5.94, at Sand Beach; least monthly, 2.14, at Evart.

**Wind.**—Prevailing direction, southwest.—*E. A. Evans, Local Forecast Official, Weather Bureau, Detroit, director.*

## MINNESOTA.

**Temperature.**—The mean was 1.3 above the normal; maximum, 86, at Winona, 10th; minimum, 0, at Sauk Center, 29th; greatest monthly range, 78, at Milan; least monthly range, 52, at Duluth.

**Precipitation.**—The average was 0.92 below the normal; greatest monthly, 3.56, at Saint Charles; least monthly, trace, at Sandy Lake Dam.

**Wind.**—Prevailing direction, northwest.—*E. A. Beals, Observer, Weather Bureau, Minneapolis, director.*

## MISSISSIPPI.

**Temperature.**—The mean was 3.0 below the normal; maximum, 103, at Yazoo City, 2d; minimum, 25, at Aberdeen, 30th.

**Precipitation.**—The average was above the normal; greatest monthly, 8.00, at Biloxi; least monthly, 0.00, at Kosciusko.

**Wind.**—Prevailing direction, north.—*R. J. Hyatt, Local Forecast Official, Weather Bureau, Vicksburg, director.*

## MISSOURI.

**Temperature.**—The mean was 1.1 above the normal; maximum, 95, at Fayette, 1st; minimum, 16, at Half Way, 15th; greatest monthly range, 67, at New Hartford and Potosi; least monthly range, 45, at Gordonville.

**Precipitation.**—The average was 1.95 below the normal; greatest monthly, 6.26, at Gordonville; least monthly, 0.00, at Conception and Tindall.

**Wind.**—Prevailing direction, south.—*J. R. Rippey, Secretary, State Board of Agriculture, Columbia, director; E. H. Nimmo, Observer, Weather Bureau, assistant.*

## MONTANA.

No report was received from this service in time for this REVIEW.

## NEBRASKA.

**Temperature.**—The mean was 0.4 above the normal; maximum, 95, at Fairbury, 8th; minimum, 10, at Whitman, 29th; greatest monthly range, 75, at Hebron; least monthly range, 46, at Burwell.

**Precipitation.**—The average was 1.58 below the normal; greatest monthly, 0.85, at Hartington; least monthly, 0.00, at Ansley and Nesbit.

**Wind.**—Prevailing direction, northwest.—*George E. Hunt, Local Forecast Official, Weather Bureau, Omaha, director.*

## NEVADA.

**Temperature.**—The mean was 2.3 below the normal; maximum, 94, at Gold Hill, 28th; minimum, 8, at Stofiel, 10th; greatest monthly range, 73, at Elko; least monthly range, 36, at Pioche.

**Precipitation.**—The average was 0.31 below the normal; greatest monthly, 0.64, at Palisade; least monthly, 0.00, at several stations.

**Wind.**—Prevailing direction, southwest.—*Prof. Charles W. Friend, Carson City, director; F. A. Carpenter, Observer, Weather Bureau, assistant.*

## NEW ENGLAND.

**Temperature.**—The mean was 2.7 above the normal; maximum, 88, at Andover, 9th; minimum, 11, at West Milan, 31st; greatest monthly range, 69, at West Milan; least monthly range, 30, at Nantucket.

**Precipitation.**—The average was 0.11 above the normal; greatest monthly, 7.37, at Mayfield; least monthly, 0.93, at Cornwall.

**Wind.**—Prevailing direction, northwest.—*J. Warren Smith, Observer, Weather Bureau, Boston, director.*

## NEW JERSEY.

**Temperature.**—The mean was 0.9 above the normal; maximum, 85, at Vineland, 9th; minimum, 17, at Charlotteburg, 31st; greatest monthly range, 61, at Somerville and Toms River; least monthly range, 41, at Oceanic.

**Precipitation.**—The average was 1.03 above the normal; greatest monthly, 6.59, at Tenafly; least monthly, 1.74, at Atlantic City.

**Wind.**—Prevailing direction, northwest.—*E. W. McGann, Observer, Weather Bureau, New Brunswick, director.*

## NEW MEXICO.

**Temperature.**—Maximum, 92, at Fort Wingate, 17th; minimum, 14, at Halls Peak, 26th; greatest monthly range, 68, at Fort Wingate; least monthly range, 40, at Santa Fe.

**Precipitation.**—Greatest monthly, 0.30, at Hot Sulphur Springs; least monthly, 0.00, at seven stations.—*H. B. Hersey, Observer, Weather Bureau, Santa Fe, director.*

## NEW YORK.

**Temperature.**—The mean was 2.8 above the normal; maximum, 86, at Humphrey, 12th; minimum, 12, at Brookfield, 31st; greatest monthly range, 65, at Humphrey; least monthly range, 39, at Setauket.

**Precipitation.**—The average was 0.72 below the normal; greatest monthly, 5.75, at Cherry Creek; least monthly, 0.63, at Ogdensburg.

**Wind.**—Prevailing direction, southwest.—*Prof. E. A. Fieries, Dean of the College of Civil Engineering, Cornell University, Ithaca, director; R. M. Hardinge, Observer, Weather Bureau, assistant.*

## NORTH CAROLINA.

**Temperature.**—The mean was 0.6 below the normal; maximum, 92, at Lumberton, 8th; minimum, 18, at Bakersville, 30th; greatest monthly range, 66, at Bakersville and Marion; least monthly range, 30, at Hatteras.

**Precipitation.**—The average was 1.86 above the normal; greatest monthly, 11.31, at Columbus; least monthly, 0.75, at Murphy.

**Wind.**—Prevailing direction, northeast.—*Dr. Herbert B. Battle, Raleigh, director; C. F. von Herrmann, Observer, Weather Bureau, assistant.*

## NORTH DAKOTA.

**Temperature.**—The mean was 1.8 below the normal; maximum, 79, at Washburn, 31st; minimum, 0, at Washburn, 28th; greatest monthly range, 79, at Washburn; least monthly range, 47, at Saint John.

**Precipitation.**—The average was 0.50 below the normal; greatest monthly, 1.70, at Milton; least monthly, 0.37, at Dickinson.

**Wind.**—Prevailing direction, northwest.—*W. H. Fallon, Observer, Weather Bureau, Bismarck, director.*

## OHIO WEATHER AND CROP SERVICE.

**Temperature.**—The mean was 2.1 above the normal; maximum, 95, at Northwood, 11th; minimum, 15, at Rittman, 28th; greatest monthly range, 75, at Northwood; least monthly range, 50, at Sharon Center.

**Precipitation.**—The average was 1.62 above the normal; greatest monthly, 7.25, at Zanesville; least monthly, 2.09, at Celina.

**Wind.**—Prevailing direction, southwest.—*L. N. Bonham, Columbus, director; C. M. Strong, Observer, Weather Bureau, assistant.*

## OKLAHOMA.

**Temperature.**—Maximum, 99, at Guthrie, 2d; minimum, 24, at Burnett, 26th.

**Precipitation.**—Greatest monthly, 0.90, at Buffalo; least monthly, trace, at Winnview.

**Wind.**—Prevailing direction, south.—*J. I. Widmeyer, Observer, Weather Bureau, Oklahoma City, director.*

## OREGON.

**Temperature.**—The mean was 3.6 below the normal; maximum, 78, at Canyon City, 14th; minimum, 12, at Lone Rock, 31st; greatest monthly range, 53, at Canyon City and Lone Rock; least monthly range, 25, at Bandon.

**Precipitation.**—The average was 1.81 above the normal; greatest monthly, 15.57, at Glenora; least monthly, 1.04, at Burns.

**Wind.**—Prevailing direction, southwest.—*Hon. H. E. Hayes, Master State Grange, Portland, director; B. S. Pague, Local Forecast Official, Weather Bureau, assistant.*

## PENNSYLVANIA.

**Temperature.**—The mean was 3.1 above the normal; maximum, 91, at Coatesville, 9th; minimum, 17, at Hollidaysburg and Smethport, 31st; greatest monthly range, 69, at Coatesville and Lagonia; least monthly range, 42, at Altoona.

**Precipitation.**—The average was 0.22 below the normal; greatest monthly, 6.58, at Blue Knob; least monthly, 1.18, at Bloomsburg.

**Wind.**—Prevailing direction, northwest.—*Under direction of the Franklin Institute, Philadelphia; W. P. Tatham, director; T. F. Townsend, Local Forecast Official, Weather Bureau, assistant.*

## SOUTH CAROLINA.

**Temperature.**—Maximum, 90, at Trial and Kingstree, 10th; minimum, 25, at Greenville, 31st.

**Precipitation.**—Greatest monthly, 8.16, at Hardeeville; least monthly, 0.72, at Greenwood.

**Wind.**—Prevailing direction, northeast.—*J. W. Bauer, Observer, Weather Bureau, Columbia, director.*

## SOUTH DAKOTA.

**Temperature.**—The mean was 0.5 below the normal; maximum, 90, at Oelrichs, 21st; minimum, 2, at Webster and Wentworth, 29th; greatest monthly range, 81, at Webster; least monthly range, 50, at Bear Valley.

**Precipitation.**—The average was 0.83 below the normal; greatest monthly, 4.70, at Forest City; least monthly, trace, at De Smet.

**Wind.**—Prevailing direction, northwest.—*S. W. Glenn, Local Forecast Official, Weather Bureau, Huron, director.*

## TENNESSEE WEATHER AND CROP SERVICE.

**Temperature.**—The mean was 0.6 below the normal; maximum, 90, at Covington, 21st; minimum, 22, at Jacksboro, 30th, and at Harriman, 31st; greatest monthly range, 65, at Springdale; least monthly range, 41, at Bethel Springs.

**Precipitation.**—The average was 0.89 below the normal; greatest monthly, 5.85, at Johnson City; least monthly, trace, at Bethel Springs.

**Wind.**—Prevailing direction, north.—*J. B. Marbury, Local Forecast Official, Weather Bureau, Nashville, director.*

## TEXAS.

**Temperature.**—The mean was 0.5 above the normal; maximum, 101, at Fort Ringgold, 2d, and at Sulphur Springs, 9th; minimum, 22, at Fort Hancock, 26th and 28th; greatest monthly range, 69, at Sulphur Springs; least monthly range, 27, at Galveston.

**Precipitation.**—The average was 1.81 below the normal; greatest monthly, 3.09, at Llano; least monthly, 0.00, at a number of stations.

**Wind.**—Prevailing direction, south.—*D. D. Bryan, Galveston, director; I. M. Cline, Local Forecast Official, Weather Bureau, assistant.*

## UTAH.

**Temperature.**—Maximum, 92, at Fillmore, 8th; minimum, 5, at Scofield,

11th; greatest monthly range, 71, at Fillmore; least monthly range, 47, at Castle Gate and Salt Lake City.

**Precipitation.**—Greatest monthly, 1.46, at Lake Park; least monthly, 0.00, at Loa and Green River.

**Wind.**—Prevailing direction, southeast.—*G. N. Salisbury, Observer, Weather Bureau, Salt Lake City, director.*

## VIRGINIA.

**Temperature.**—Maximum, 89, at Ashland and Avon, 9th; minimum, 19, at Big Stone Gap, Lexington, and Marion, 30th; greatest monthly range, 63, at Big Stone Gap; least monthly range, 35, at Cape Henry.

**Precipitation.**—Greatest monthly, 12.61, at Avon; least monthly, 2.10, at Cape Henry.

**Wind.**—Prevailing direction, northeast.—*Dr. E. A. Craighill, Lynchburg, director; J. N. Ryker, Observer, Weather Bureau, assistant.*

## WASHINGTON.

**Temperature.**—Maximum, 83, at Davenport, 26th; minimum, 12, at Waterville, 23d; greatest monthly range, 70, at Davenport; least monthly range, 16, at Tatoosh Island.

**Precipitation.**—The average was 0.59 above the normal; greatest monthly, 11.44, at Neah Bay; least monthly, 0.19, at Bridgeport.

**Wind.**—Prevailing direction, south.—*H. F. Alciatore, Observer, Weather Bureau, Olympia, director.*

## WEST VIRGINIA.

**Temperature.**—Maximum, 86, at Buckhannon and New Martinsville, 12th, and at Point Pleasant, 11th; minimum, 16, at Marlinton, 31st; greatest monthly range, 66, at Central Station; least monthly range, 50, at Ella.

**Precipitation.**—Greatest monthly, 7.22, at Bluefield; least monthly, 2.95, at Grafton.

**Wind.**—Prevailing direction, west.—*W. W. Dent, Observer, Weather Bureau, Parkersburg, director.*

## WISCONSIN.

**Temperature.**—The mean was 2.0 above the normal; maximum, 89, at Prairie du Chien, 8th; minimum, 7, at Haywood, 29th.

**Precipitation.**—The average was 0.50 below the normal; greatest monthly, 5.22, at Ashland; least monthly, 1.37, at Manitowoc.

**Wind.**—Prevailing directions, south and southwest.—*W. L. Moore, Local Forecast Official, Weather Bureau, Milwaukee, director.*

## WYOMING.

**Temperature.**—Maximum, 82, at Fort Yellowstone, 16th; minimum, 9, at Laramie, 26th; greatest monthly range, 60, at Cheyenne; least monthly range, 51, at Saratoga.

**Precipitation.**—Greatest monthly, 2.20, at Saratoga; least monthly, 0.18, at Fort Washakie.

**Wind.**—Prevailing directions, west.—*E. M. Ravenscraft, Observer, Weather Bureau, Cheyenne, director.*

## OBSERVATIONS ON THE GREAT LAKES.

## REPORTS FROM VESSELS.

The Lake Marine Section of the Forecast Division has received a number of reports for October from the captains of 39 vessels navigating the Great Lakes. The following miscellaneous items are extracted from their reports.

Capt. Frank D. Root, s. s. "Maritana," reports on October 14, p. m., at the entrance to Detroit River, water so low could not go up the river.

Capt. F. A. Graves, s. s. "Maton," navigating Lakes Michigan and Superior, reports October 5, northeast gale continuing over to the 6th, and northwest gale October 7. Also a north-northwest gale October 14-15.

Capt. Thos. Hackett, s. s. "Volunteer," Saginaw Bay, on October 5, reports northern lights shone very plainly from 10 p. m. till midnight. On October 1 he states that "the Bell buoy off Point aux Barques in my judgment is of much benefit to boats passing in the thick weather and dark nights, and I think more of them could be used on the Lakes with good results, one off Sturgeon Point, and one off Middle Island reef, Lake Huron, would be of much benefit to passing boats, and one off Wangoshanee light, and wherever boats have to pass close to shoal places they are of much benefit."

Capt. Hugh O. Miller, s. s. "Conemaugh," on Lake Erie, reports October 6, noon, barometer the lowest I ever saw it.

Capt. J. W. Morgan, s. s. "Australasia," on Lake Michigan, October 6, aurora very bright 8.30 p. m.

Capt. Edward Mooney of the s. s. "Wa-Wa-Tam," on Lake Superior, reports October 5, northern lights from 3 a. m. until 4 a. m.

Capt. R. E. Gain, s. s. "W. H. Sawyer," on Lake Michigan, reports October 3, 11 p. m., bright flashing northern lights. Reports also important obstacle in the channel just west of waterworks crib, abreast of Buffalo.

Capt. James Parsons, s. s. "Charles Hebard," on Lake Michigan, reports on October 1, 10 p. m., a most beautiful and well-defined aurora visible, not a cloud in the sky although the wind was blowing 7 miles from southeast

at the time. October 13th and morning of 14th, the barometer the lowest that it has been with us in 7 years.

Capt. John Lowe, s. s. "Kalliyuga," on Lake Huron, reports an important obstruction north of Ashtabula Piers; also another southwest from Point Pelee, Ont., and another southeast from Bar Point, Lake Huron.

Capt. C. W. Woodgrift, s. s. "F. R. Bull," on Lake Michigan, reports an obstruction, the mast of str. "Wocokin," 6 miles above Long Point and about 3 miles from shore.

Capt. Hourigan, s. s. "Hecla," reports frost on the morning of the 10th at Ogdensburg. On the 13th he sailed into Lake Ontario into a heavy sea and southeast gale; his barometer falling rapidly to 28.54. The "Hecla" rolled her smoke stacks out, could not make steam, parted hawsers and went ashore 2 miles east of Wellington. Capt. Hourigan claims that he did not have due notice of this storm or he might have avoided it.

Capt. C. W. Lockwood, s. s. "Bennington," reports October 11, Ashland, Mich., on Lake Superior, thunder and lightning and heavy rain. On the 14th, in the morning, near Whitefish Point, northwest hurricane and heavy cross seas; barometer 28.75 (aneroid, approximately, reduced to sea level). 15th and also 29th, at the lower end of Lake Superior, squalls of snow and hail.

Capt. Fred Howe, s. s. "Aztec," October 11, 8 p. m., to 12th, 8 a. m., on Lake Erie, reports clouds heavy with sheet lightning in the northwest.

## REPORTS FROM U. S. LIFE-SAVING STATIONS.

Through the kind co-operation of the General Superintendent of the Life-Saving Service and the Secretary of the Treasury, the Weather Bureau has received 454 weekly transcripts of journals for the month of October from the keepers of 39 U. S. Life-Saving stations on the Great Lakes. The mean pressures, temperatures, and winds will be useful in



the compilation of monthly summaries and charts. The following special notes by the respective keepers are extracted from these reports:

*Big Sandy Creek, Lake Ontario.*—10th, during the fore part of this night the northern lights were very brilliant; 14th, much damage by gale.

*Manistee, Mich.*—24th, sea was high and rough all day, but did not notice any current.

*Middle Island, Lake Huron.*—1st, northern lights 8 p. m.; 5th, northern lights about 8 p. m.; 9th, 8.30 p. m., northern lights; 11th, northern lights; 17th, northern lights 11.30 and continued after midnight; 18th, northern lights continued to 2 a. m.

*Oswego, N. Y.*—3d, had dim northern lights from 12 midnight to 5 a. m.; 9th, northern lights were plainly visible from 10 p. m. to midnight; 10th, bright northern lights from 12 midnight until 5 a. m.

*Point aux Barques, Mich.*—14th, barometer from 8 a. m. until 3 p. m. at 28.11, is the lowest it has ever been since being in use at this station (about 8 years); 28th, 11 a. m., first snow of the season.

*Point Betsey, Lake Michigan.*—17th, bright northern lights from 10 to 12. *Sturgeon Point, Harrisonville, Mich.*—13th, a heavy fog hung over the lake all day, the worst of the season.

*Vermillion Point, Lake Superior* [Post office, Whitefish Point, Mich.].—S. F. Bernier, keeper, reports, October 2d, at 3 p. m. the water in the Lake went down all at once 8 inches, and remained so for 15 minutes and then began to rise, and it rose 10 inches above the level and remained so for a few minutes (3 or 4), and then went down to its level and remained so for 30 minutes and again rose to 14 inches above the level and went down almost as quick and fell 18 inches below the level and it continued so till 8 o'clock that evening; the wind was southeast, fresh by spells, weather cloudy and occasionally rain, the wind shifting to the northwest, light at first at 8.30 p. m., thence increased to a gale by 12 o'clock, midnight. Barometer was falling very fast during the afternoon. 14th, this was the worst storm that we have had for years; the strongest wind and the biggest sea in my sixteen years on this station. 15th, the highest sea that ever was, it washed a solid bank of sand for one-quarter of a mile on to the land—took away our breakwater, pump-house, and look-out. 18th, white geese and ducks going south.

### NOTES BY THE EDITOR.

#### THE COLD WEATHER STORMS OF INDIA AND AMERICA.

The cold waves that flow over the United States from the Northwest during the cold season, November to March, are analogous to the cold weather storms that occur in India during December, January, and February. These latter have been made the subject of study by the meteorological office at Calcutta, and an extensive memoir on the subject by J. Eliot, the superintendent of that office, has just been received, which will be of value to the students of American weather, and from which we extract the following paragraphs:

In India these storms occur during the prevalence of the northeast monsoon and they are of great economical importance, as the snowfall of the Himalayas occurs chiefly during their existence; they also give more or less rain to northern India. The character and value of the wheat and other crops of northern India largely depend upon the amount and distribution of the rainfall during these storms of the cold weather months. In some years the number of these storms is much less than usual and the rainfall scanty, and consequently the wheat crop fails more or less in the unirrigated regions; the more elevated the district the greater the failure. In other years these storms are of frequent occurrence and give moderate to heavy showers at short intervals; in such years the wheat crop of northern India is generally generous and there is usually a surplus available for export to Europe.

The cold weather storms originate during a period when dry land-winds prevail in India and when the lower atmospheric strata over northern India contain only from one-half to one-third the amount of moisture which is present in the air during the rains or southwest monsoons. A great variety of these storms march in an easterly direction across northern India, or in the opposite direction to that in which the cyclonic storms of the southwest monsoon period usually advance across northern India. They sometimes enter India from Baluchistan on the northwest and advance east or east-southeast across the whole breadth of India into Burmah, where they disappear either by filling up or by advancing into farther India where there are no meteorological observations at present available. They never enter India from the adjacent seas. On the other hand, the cyclonic storms of the rainy season generally enter India from the Bay of Bengal and move westward.

After giving a full description of all the more important cold weather storms during the sixteen years, from 1876 to 1891, Mr. Eliot says:

Cyclonic storms may originate under various combinations of circumstances, and any attempt to formulate a theory for all will necessarily fail to explain many important features of a special class. He arranges the storms of India as follows: (1) cyclonic storms of the southwest monsoon season; (2) cyclonic storms of the cold weather or northeast monsoon season; (3) storms of the hot season, including tornadoes, "nor'westers," thunderstorms, hailstorms, duststorms, etc.; these are usually of very small extent and rarely last more than a few hours.

The prominent features of the first class of storms are as follows:

A. They form over the Indian Sea, and especially the Bay of Bengal.

B. They move toward the west and north, and sometimes northeast, the mean direction being west-northwest.

C. The central barometric depression is frequently very large and the winds very violent.

D. They give excessive rain, total falls of 15 to 20 inches being by no means unusual in the districts over which they pass.

E. The temperature changes are also small and are due to the rainfall.

The characteristics of the second class or cold weather storms are:

a. They form in northwestern India or advance into that region from the plateaus and mountains of Persia, Afghanistan, and Baluchistan.

b. They advance toward the east and east-southeast with great uniformity.

c. A large proportion of the storms give rise to subsidiary depressions in the Punjab with very marked cyclonic features.

d. The barometric depression in the primary disturbances is always small in amount, and the rainfall in the plains of northern India due to these storms is usually moderate in amount, rarely exceeding 3 or 4 inches.

e. The changes in temperature and humidity accompanying these storms are usually very marked. Every storm of importance is preceded in its advance across India by a warm wave and is followed by a cool and dry wave.

The first indication of a cold weather storm is usually a local fall of the barometer in Baluchistan, on the west frontier, and is followed by the appearance of a shallow depression on the northwest frontier; this latter drifts across northern India to the east or east-southeast and either fills up in northeastern India or passes farther eastward into Burmah. There is usually a considerable increase of temperature in front of the advancing depression; these depressions usually give light or moderate rain in their eastern and northern quadrants; little or no rain falls in the central area, and still less in the south quadrant. The effects of these storms are restricted to northern India, viz., from the north of the Deccan (between N. 20° and 35°).

In the majority of cases the appearance of barometric depressions on the west frontier is followed by the formation of deeper and smaller depressions to the northward in central and northern Punjab; these latter are usually almost stationary and fill up as rapidly as they form, while the previously existing shallow depressions to the southward are moving east to Bengal; the barometric changes in the Punjab, due to these deeper depressions, are occasionally very large and rapid; evidently the latter depend for their formation upon some atmospheric action connected with the eastward advance of the shallow depressions to the southward; they are, therefore, to be considered as secondary and subsidiary to them.

The subsidiary depressions in the Punjab are invariably accompanied by more or less heavy snowfall in the western Himalayas and in the Afghan mountains, and by moderate rain in the north and east Punjab; during their existence the heaviest and most extensive snowfalls in the hill districts of upper India, and the most general rain during the cold weather season in the plains of northern India usually occur. Out of a total of fifty-five primary storms or shallow depressions during the years 1876-1891, thirty were accompanied by secondary storms or depressions in upper India. The secondary are definitely related to the primary depressions, forming and disappearing during a well-defined stage in the progress of the latter, and their formation is almost certainly the result of special actions set up in the Punjab by the primary disturbances.

When there is a general decrease of pressure over the Indian area of north-east monsoons then the shallow primary depressions appear in northwestern India. There is an oscillation in the general pressure over this region which has a period of about five days in the cold weather season; this oscillation was particularly well marked in November and December, 1892, and was at that time almost simultaneous and uniform over a region extending a thousand miles in latitude and three thousand in longitude; hence the oscillations have the character of fairly regular pulsations and are not the result of any abnormal conditions, and are not likely to be due to the passage of waves of high and low pressure. Out of forty-four storms during the years 1878-1891, thirty-one formed or appeared in the northwestern frontier districts during that portion of barometric oscillation over the whole of India in which the barometer was falling, and only thirteen storms occurred when the barometer was rising, so that it is probable that the oscillatory decrease of pressure is favorable to the formation of the primary depressions of the cold weather storms; and, in fact, that these storms form within the areas of oscillatory depressions and probably, as a rule, not farther west than Baluchistan. An examination of the observations made in Persia shows that about one-third of these primary depressions are the continuation of depressions that had passed over central Persia three or four days before reaching the northwest frontier of India, so that in general out of forty-four storms during the years 1878-1891, seven apparently originated west of Baluchistan, nineteen in Baluchistan, and eighteen in upper or northwest India. Of those that have been traced back to central Persia, none can be clearly traced so far as Europe, and it is probable that the cold weather storms of India are not the continuation of European storms.

One of the most remarkable features of these storms is that a very large

proportion of them are double disturbances, consisting of a primary and secondary depression; the primary depression rarely exceeds 0.3 inch, and is usually 0.2. The secondary depressions begin to form when the primaries are entering or passing through Sind or west Rajputana; they vary much in importance but are generally deeper than the attendant primary depressions; it is only when a deep stationary secondary depression forms in the Punjab that strong stormy winds are experienced in the plains. These storms can not be ascribed to sea wind in the lower atmospheric strata. At the level of the plains the cyclonic circulation is feeble and somewhat irregular in the primary depressions, and the aqueous vapor which is condensed into rain is drawn from some upper current of the atmosphere and not from the lowest sea breezes. In the case of secondary depressions, although the winds may be stronger, yet it does not appear that the depression is maintained by vapor drawn from the lower strata, and Eliot concludes that for both these primary and secondary depressions the cyclonic circulation is chiefly developed and maintained by the middle and possibly a higher atmospheric strata, probably between 10,000 and 25,000 feet. Hence they are storms of high elevation and higher than the storms of the southwest monsoons proper, and the movement of the air at the level of the plains is comparatively feeble and of no importance so far as the maintenance of the indraught and the storm is concerned.

With regard to temperature: (a) each primary storm is preceded by a warm wave and the increased temperature occurs chiefly during the night, as shown by the morning minima; (b) the area of the warm wave precedes the storm-center by about twenty-four hours, so that the barometric depression on any day covers the area of greatest excess of temperature of the previous day; (c) these temperature features are almost certainly due chiefly to the effect of a thin veil of cloud or haze in the outskirts of the advancing storm in obstructing terrestrial radiation at night; (d) the increased temperature in front is determined by the advancing storm, and is a resultant of actions set up by the storm. Within the storm area itself the temperature conditions depend in part upon the amount of clouds and in part upon the occurrence of rainfall. The effect of moderate or thick clouds is to diminish the temperature of the lower air and the earth's surface by day and increase it by night. The effect of rainfall is of considerable importance, as it cools the lower air in its descent, and also cools the ground.

A cool wave usually advances across India in the rear of each primary depression. Very clear, bright weather obtains in the rear of these storms, but the maximum day temperature continues for some days more or less below the normal, while the night temperature falls very rapidly. During the strong westerly winds that prevail for one, two, or three days after the passage of these storms the day temperature is more largely in defect, as compared with the normal, than the night temperatures. The mean temperature of the day after the passage is usually from 8° to 14° below the mean temperature of the day previous. The reduction of temperature appears to be mainly dependent upon the amount of snowfall during the storm and the height at which the snowfall remains unmelted on the mountain sides. The cooling effect is directly related to the dryness of the air of the westerly winds in the rear of the storm, being greater as the air is drier. The phenomena of temperature in the hill districts of India differ considerably from those in the plains; at the hill stations, at the end of the storm the temperature is largely below the normal and considerable snow is on the ground; for the next few days the temperature rises very slowly, but as soon as the greater part of the snow has melted the temperature rises, with great humidity.

Eliot states that the phenomena of the cold waves in India suggest that the air is usually cooled as it descends from the high land of Baluchistan, Afghanistan, and the western Himalayas; after cooling it descends; after descending it spreads southward as a comparatively thin stratum over the earth's surface. The temperature of the descending mass has been mainly determined by the elevation at which the snow is lying on the mountains and plateaus. The cool stratum is generally too shallow to surmount the western ghats or to pass over the Satpura Mountains, hence the cooling effects are not felt in the Deccan.

With regard to atmospheric moisture, its variations during the progress of the storms are generally excessive; there is a slight increase in absolute and relative humidity in front of the storm and a large increase when rain has fallen in advance of the storm, but a very large and rapid decrease immediately following the passage of the storm; this effect is transmitted eastward from the northwest frontier at a rate that is practically identical with the advance of the storm. The formation of cloud occurs chiefly in the eastern and northern quadrants; the cloud canopy frequently extends from four to eight times as far in front as it does in the rear; in front of the storm the changes from light cirrus to thick nimbus or pallium occur much as they do in European cyclonic storms; to the west of the center the cloudiness diminishes rapidly, and occasionally terminates almost abruptly in a sharp line beyond which the cloudless skies are unusually bright and clear; there is a special development of cloud in the northern quadrant over the Himalayas.

Rain occurs in northern India almost exclusively during these storms or depressions; the rainfall occurs chiefly in the northern and eastern quadrants of the primary depression; it is small in the central area and the south and west quadrants; the rainfall very frequently accompanies thunderstorms, and is therefore irregularly distributed; when a primary gives rise to a secondary depression in the Punjab the rainfall is much greater in that region than in any other part of northern India; in general, the rainfall during the double disturbances is nearly twice as much as during the single ones; the rainfall increases in amount as you go from the center of the depression northward to the foot of the hills, where it is ten times as large as near the center, thus show-

ing the very great influence exerted by the Himalayas; these storms give to the Himalayas a heavy snowfall, which not uncommonly amounts to 40 or 50 feet in the middle ranges and interior districts of that range of mountains.

The single disturbances or cold weather storms that have a primary but no secondary depression, are those whose tracks pass over the most northern portion of India; they give little or no rain to the plains of upper India; they move nearly due east, and within two days after their appearance in Sind they break up over the Himalayas, the mean rate of motion being 350 miles a day. The second class of storms, viz., those accompanied by secondary depressions, pursue tracks lying farther to the south and pass from the northwest frontier between N. 25° and 30° eastward over the whole breadth of northern India, the majority passing into Burmah at an average rate of 350 miles a day.

The comparison of successive years shows that the number of depressions varies very much; sometimes they succeed each other at the rate of from two to four in a month, at other times not more than one or two occurred during a whole season. The characters of the depressions vary largely; in some years they are almost exclusively shallow, primary depressions without secondaries; in other years they are to a great extent double disturbances and bring abundant rain to the plains and heavy snow on the hills; the tracks for any season are fairly persistent throughout the whole, being in one year more northerly and moving more directly easterly than in another year. The consequent irregularities in quantity and distribution of rain and snow during the cold weather season considerably exceed the irregularities of the rainfall during the southwest monsoon. The antecedent conditions that determine the character of these cold weather storms for any year are probably to be sought, not at a great distance, such as Europe, but in the Indian monsoon area and the adjacent regions. Eliot enumerates seven such possible antecedent characteristics of the monsoons, and gives a brief summary of the facts for and against the hypothesis that each of these is an important factor that could be utilized in forecasting the general character of the cold weather. One of these seems to be a matter of importance, namely, the relation between changes of pressure in the atmosphere at the lower level of the plain and at the upper level of the hills in northern India. Eliot shows that in the great majority of cases the cold weather rains have been heavier, or excessive, when the pressure at the upper level is below the normal, as computed on the basis of the pressure at the lower level, and on the other hand that the rainfall has been deficient when the pressure at the upper level is greater than the normal; apparently an excess of pressure at the high level stations means an excess in the middle atmospheric strata over northern India.

The data for 1876-1891 show conclusively that large vertical pressure anomalies in northern India are always associated with large variations in the rainfall; negative anomalies accompany excess and positive anomalies deficient rainfall. As the vertical pressure anomalies, especially when large, are not only persistent but antecedent to the cold weather rainfall, they may therefore be utilized in November and December to forecast the probable character of the following cold weather rains.

The following conclusions are formulated by Mr. Eliot, viz.:

"(3) If the vertical pressure anomalies are persistently negative throughout October to December, it is very probable that the cold weather rains from December to March will be heavier than usual, and the weather on the hills especially stormy. (4) If the vertical pressure anomalies are persistently positive from October to December, it is very probable that the following cold weather rains, from December to March, will be light, and the weather on the hills less disturbed than usual. (5) Continued stormy weather during the cold weather season is almost invariably associated with a local deficiency of pressure in the middle atmospheric strata, or with large negative anomalies, and the amount of the precipitation varies, on the whole, with the magnitude of the anomalies. (6) Unusually fine and settled weather in the months of December, January, and February is almost invariably associated with excessive pressure in the middle atmospheric strata, or with what may be called anticyclonic conditions at a high altitude, and the deficiency in the rainfall varies directly with the magnitude of the positive anomalies."

Mr. Eliot is finally led to frame a simple explanation as to the origin and nature of these cold weather storms, of which the following is a synopsis:

They are phenomena of the upper atmospheric currents over northern India; the lower air currents are comparatively shallow and their direction is largely determined by the geographical features of the country; the mean direction of motion of the upper current is from the south 85° west, which current is one of the larger features of atmospheric circulation which have been fully explained by Ferrel. The cold weather storms are large whirls generated in this upper current whose motion is rapid and remarkably steady in direction; the motion of the storms or storm-whirls is largely determined by the movement of the mass of air in which they are embedded; the mean direction of their advance is from a point north 75° west, which differs only 20° from the general motion above given for the upper current as south 85° west. The rate of advance of the cold weather storms is from 300 to 500 miles a day, and therefore much greater than that of the southwest monsoon storms, but probably comparable with the average velocity of that portion of the upper current with which they drift eastward. They resemble in several important features the cyclonic storms of Europe and the United States.

The primary depression of the barometer is a dynamical effect due to the larger whirl in the upper current, which is a humid current, and receives its largest supplies of aqueous vapor at this season of the year by the ascensional motion in the equatorial belt of the Indian Ocean. When the primary depressions are crossing Sind and west Rajputana the southerly humid winds



in the eastern quadrant of the advancing depression are directed toward the western Himalayas and are forced upward by that mountain mass. Hence these storms give more cloud or rain or snow to the hills than to the plains. This forced ascensional movement on the eastern flank of the western Himalayas, as determined by the peculiar geographical features of the Punjab, results in the formation of the local whirls and secondary depressions attending the primary whirls. The growth and existence of the secondary depression thus initiated depends upon the condition of the upper current and the location of the primary whirl; when the latter reaches central India or south-east Rajputana, the supply of humid wind is cut off and the secondary begins to disappear. As the primary whirls are features of a higher current the secondary whirls would also belong to this current, hence the position and motion of the secondary whirl would be determined mainly by the highest ranges of the mountains inclosing the Punjab. As the chief indraft is at considerable elevation, therefore strong cyclonic winds are experienced in the western Himalayas, while at the level of the plain the cyclonic winds are lighter.

Both primary and secondary depressions are most numerous during the months of January and February, when it is most probable that the upper currents in which they form are strongest and carry most vapor. Eliot finds that the above conclusions explain all the more important features of the distribution of the rainfall in the plains of northern India and the snowfall in the western Himalayas and the mountains of Afghanistan, and hence also the peculiar features of the cool, dry waves which advance across India after these storms. The explanation of the latter is similar to that advanced by the editor for the cool waves of North America, differing only in the importance assigned to special geographical conditions in relation to the snowfall to the north and west of northwestern India.

There appear to be certain residual effects related to the secondary depressions, but not to the primaries, and consisting of certain shallow slow-moving depressions, which Mr. Eliot thinks may be explained by the fact that the lower air circulation in a cyclone is much more easily broken up than the higher circulation; the former may be disintegrated by hilly ground, while the upper portion may continue intact.

Referring to the work done by Mr. Blanford and Mr. S. A. Hill on the connection between the southwest monsoon rains and the cold weather rains, Mr. Eliot shows that there is a marked tendency for deficient rainfall during the southwest monsoon in upper India to be followed by deficient rain or snow in the succeeding cold weather. It is this combination of failure of the cold weather rains, following upon failure of the preceding southwest monsoon rains, that has given rise to the great majority of droughts and famines in northwestern India. During fifteen years (1878-1892) there were seven in which the southwest monsoon rainfall, namely, from June to September, was deficient in the Punjab, and in five of these years the rainfall of the following cold weather period, December to March, was also deficient, and in four years very considerably so.

Mr. Eliot concludes that the further study of this subject must depend upon the preparation of daily charts over the little-known area between India and Europe, and perhaps the preparation of international charts for the Northern Hemisphere.

#### THE EFFECT OF GALES IN CAUSING HIGH WATER.

The influence of the wind and tide, and possibly the low barometric pressure of a storm area, in causing an unusual rise of water is the occasion of much of the damage and loss of life that attends the storms of the Atlantic and Gulf coasts. Observations tending to fix the extent of this high water and the special causes that produce it are always desirable. We submit herewith the records of water, wind, and pressure for two storms, viz., June 4 to 5, 1891, at Galveston, and October 12 to 13, 1893, at South Island, Winyah Bay, S. C. The latter was furnished by Gen. E. P. Alexander, and the former by Dr. J. M. Cline, of the U. S. Weather Bureau. Winyah Bay, having Georgetown, S. C., at its head, is subject to high water when east and south winds prevail; its mouth is about 50 miles northeast of the city of Charleston; it is therefore east of the path of the center of the hurricane of August 27, 1893, on which occasion the maximum height of the water was 9 feet above the zero of the gauge, which is approximately mean low water; on October 12-13, it lay nearly in the track of the hurricane center, and the maximum height of the water was 11.6 feet. Similar high water prevailed on both these dates along the middle and south Atlantic coasts; the official reports from Beaufort, S. C., by Lieutenant Cushing, of the Revenue Marine, show that about 500 persons were drowned in that region during the August hurricane.

The location of Galveston, on the inside or northwest side and at the northeast end of a long island and facing Galveston Bay on the north and west, is such that northeast and especially southeast winds cause an accumulation of water in the harbor, but not to such an extent as in many other places for two reasons, first, the large area of the harbor as compared with the size of its inlets, second, the fact that a portion of the water is usually flowing out of one opening while flowing in at another, so that the actual rise is the difference between the inflow and outflow. The storm-center of July 4-6 recurred just west of Galveston, so that that city experienced an unusually long continuance of northeast backing to southeast, and finally southwest winds; the greater rise of water occurred simultaneously with the northeast and southeast winds, but a rapid and decided rise and fall followed two hours after the maximum southwest wind in a well-marked sequence.

In Winyah Bay, under the influence of winds that were estimated at 90 miles, although doubtless the maximum velocity of the open sea may have exceeded this, the actual height of the water exceeded that due to the natural

tide by 7 or 8 feet between 2 a. m. and 9 a. m. of October 13th. At Galveston under the influence of easterly winds, whose measured velocity attained 44 miles, the maximum gauge reading was 4.6, and therefore less than 4 feet above the slight natural tide. At both these stations, therefore, the rise in the water surface attributable to the winds is in both cases about twenty times greater than the height of a column of water that can be sustained by such winds in statical equilibrium, as in the Lind anemometer, and this factor is only slightly diminished by making some allowance for the rise of water due to the diminished barometric pressure.

Observations during storms of June 4-5, 1891, at Galveston, Tex., and October 12-13, 1893, at South Island, S. C.

1891.	Galveston, Tex.				1893.	South Island, Winyah Bay, S. C.				
	Barometer.	Direction.	Velocity.	Actual water.		Barometer.	Direction.	Velocity.	Natural tide.	Actual water.
July 4.	Inches.		Miles.	Feet.	October 12.	Inches.		Miles.	Feet.	Feet.
Noon.....				2.1	8 a. m.....	29.85	ne.	20	3.2	4.0
1 p. m.....				2.3	9 a. m.....		ne.		3.8	4.8
2 p. m.....				2.2	10 a. m.....	29.81	ne.	22	3.4	4.5
3 p. m.....				2.0	11 a. m.....				2.7	4.0
4 p. m.....				2.1	Noon.....	29.80		24	2.2	3.4
5 p. m.....				1.7	1 p. m.....				1.4	2.9
6 p. m.....				1.6	2 p. m.....	29.70	ne.	26	0.6	2.4
7 p. m.....	29.96	e.	20	1.3	3 p. m.....		ne.		0.3	2.2
8 p. m.....		e.	24	1.0	4 p. m.....	29.70	ne.	28	0.5	2.5
9 p. m.....		e.	24	0.8	5 p. m.....				1.0	3.0
10 p. m.....		e.	24	1.0	6 p. m.....	29.69		32	1.5	3.6
11 p. m.....		se.	26	1.2	7 p. m.....				1.9	4.3
Night.....			28	1.7	8 p. m.....	29.62		42	2.4	4.8
July 5.					9 p. m.....				2.8	5.3
1 a. m.....		e.	30	2.3	10 p. m.....	29.50	ne.	52	3.2	5.9
2 a. m.....		ne.	36	2.9	11 p. m.....		ne.		2.6	6.4
3 a. m.....		e.	36	3.4	Night.....	29.48	ne.	58	3.0	6.9
4 a. m.....		se.	36	4.0	October 13.					
5 a. m.....		ne.	27	4.4	1 a. m.....				1.3	7.3
6 a. m.....			36	4.5	2 a. m.....	29.40	ne.	64	0.7	7.9
7 a. m.....	29.78		44	4.6	3 a. m.....		ne.		0.2	8.2
8 a. m.....			33	4.65	4 a. m.....	29.30	ne.	66	0.4	8.4
9 a. m.....		nne.	4	4.4	5 a. m.....				0.9	8.5
10 a. m.....		ne.	17	4.1	6 a. m.....	29.18		72	1.5	8.6
11 a. m.....			6	3.8	7 a. m.....				2.0	8.7
Noon.....	ae.		13	3.6	8 a. m.....	28.95	ne.	78	2.5	9.2
1 p. m.....	29.80		17	3.6	9 a. m.....		ne.	90	3.2	10.8
2 p. m.....			12	3.2	9.30 a. m.....					11.6
3 p. m.....			20	3.1	10 a. m.....	28.33	calm	calm	3.7	11.3
4 p. m.....			20	3.0	11 a. m.....		w.	66	3.3	8.8
5 p. m.....			24	2.9	Noon.....	28.95	w.	50	2.3	6.8
6 p. m.....			28	2.7	1 p. m.....		w.		1.6	5.2
7 p. m.....	29.62		40	2.4	2 p. m.....	29.16	w.	40	1.0	3.7
8 p. m.....	29.24		60	2.1	3 p. m.....		w.		0.5	2.7
9 p. m.....		sw.	26	3.6	4 p. m.....	29.30	w.	28	0.3	2.3
10 p. m.....			36	3.8	5 p. m.....		w.		0.8	2.1
11 p. m.....			22	1.9	6 p. m.....	29.40	w.	24	1.5	2.1
Night.....			24	1.7	7 p. m.....		w.		2.0	2.1
July 6.					8 p. m.....	29.45	w.	22	2.5	
1 a. m.....			24	1.7	9 p. m.....		w.		3.2	
2 a. m.....			19	1.7	10 p. m.....	29.50	w.	20	3.7	
3 a. m.....			21	1.9						
4 a. m.....			16	1.6						
5 a. m.....			17	1.7						
6 a. m.....			19	1.9						
7 a. m.....	29.84		24	2.4						
8 a. m.....		sw.	20	2.0						

NOTE.—The rainfall at Galveston, Tex., from July 4th, noon, to July 5th, noon, was 1.53 inches. The rainfall at South Island, S. C., from October 12th, 8 a. m., to October 13th, 8 a. m., was 4.5 inches.

The height of a column of pure water that can be sustained in statical equilibrium, as in the Lind anemometer, by the steady pressure of the wind is given in the following table; the height of a column of sea water would be about 3 per cent less:

Wind velocity, miles per hour.	Column of pure water, inches.
20	1.0
40	2.1
60	3.1
80	4.2
100	5.2
120	6.2

But in the free water of rivers, lakes, and oceans we have not to do with a static phenomenon; the water is free to move, and the first tendency of the wind to push the water on shore and pile it up is followed by a return underflow. The wind therefore pushes the surface water up a gentle slope as fast as the water in front at the top of the slope can sink to the ground and return by the undertow. There is an intermediate plane of no horizontal movement, which plane also has a gentle slope equal to about one-half or one-third of that of the surface water, and we must consider the wind as merely pushing surface water up this latter slope. The work that the wind does is simply to maintain a fairly steady flow up this slope until the surplus pressure at the upper end is just sufficient to overcome the resistances that accompany the

fairly regular return flow of the undertow, but as the wind is the ultimate motor power, we may say that the wind maintains the circulation of the water flowing toward the shore and then returning, and the force with which the wind would press against a stationary vertical wall of water is here converted into the work done in overcoming the forces that resist the movement of water. If the water surface is quite smooth then the principal resisting force that has to be overcome is the so-called viscosity, or internal friction of water flowing over water, but ordinarily this surface is thrown into waves and breakers which stir the shallow waters down to the very bottom and thus add another class of resistance called convective or vortex resistance.

SUMMARY OF OBSERVATIONS MADE BY WILLIAM DUVAL, VOLUNTARY OBSERVER, WEATHER BUREAU, AT THE WHALING STATION OF JOHN O. SPICER AT SIGNOWYA.

This station is apparently on a small island on the coast a little south of the

mouth of Cumberland Sound, in latitude N. 63° 28', W. 64° 30'. The height of the ground above sea-level is noted at 35 feet, so that the reduction of the barometer will be +0.04, but this correction has not been added.

The aneroid was compared with the Weather Bureau mercurial barometer at Washington and again at New London before Mr. Duval sailed from that port, about July 7, 1891, and it may be assumed that at that time its reduction to the standard was zero. The reduction of a mercurial barometer to standard gravity is -0.011 at New London and +0.048 at Signowya.

The thermometer had been properly verified. The air temperature, pressure, wind, and clouds were observed at 7 a. m., 2 p. m., and 9 p. m., daily, apparently on local time, which was also used for other records. The maximum and minimum temperatures were given by self-registering thermometers. Nothing is known as to the exposure of thermometers.

The wind force is recorded on a scale of 0 to 10.

The following table summarizes the results of Mr. Duval's observations:

Summary of observations at Signowya, Cumberland Sound.

Year and month.	Pressure.								Temperature.																				
	Mean.			Maximum.		Minimum.		Mean pressure, 7 a. m. + 2 p. m. + 9 p. m. ÷ 3.	Mean.			Maximum.		Minimum.		Mean maximum.	Mean minimum.	Mean temperature, 7 a. m. + 2 p. m. + 9 p. m. ÷ 3.											
	7 a. m.	2 p. m.	9 p. m.	Reading.	Date.	Reading.	Date.		7 a. m.	2 p. m.	9 p. m.	Reading.	Date.	Reading.	Date.														
1891.	Inches.	Inches.	Inches.	Inches.		Inches.		Inches.	°	°	°	°		°		°	°	°											
September .....	29.704	29.706	29.718	30.16	13	29.30	27	29.709	33.3	40.0	31.1	54	1	18	30	43.3	25.9	33.9											
October .....	29.550	29.553	29.550	29.92	6, 15	29.30	3, 10, 31	29.551	16.8	21.2	14.8	35	1, 9	12	31	23.2	11.5	16.9											
November .....	29.752	29.749	29.754	30.10	9, 28	29.40	1	29.752	-3.9	-2.7	-5.3	+6	13	-20	21	-2.5	-7.0	-4.3											
December .....	29.772	29.776	29.778	30.10	6, 7, 31	29.50	8	29.772	-17.5	-16.8	-17.9	-6	1, 6, 8	-26	22, 27	-16.6	-18.1	-17.5											
1892.																													
January .....	29.737	29.738	29.741	30.46	12	29.00	25	29.739	-9.2	-9.0	-9.5	40	6	-26	28	-8.3	-11.1	-9.3											
February .....	29.950	29.948	29.952	30.72	21	29.32	24	29.950	-6.8	-6.7	-7.2	34	14	-28	8	-6.6	-8.2	-7.0											
March .....	29.855	29.854	29.859	30.36	6	29.24	8	29.857	-0.9	-0.3	-1.0	18	10	-16	18, 22	0.5	-3.6	-0.8											
April .....	29.904	29.911	29.911	30.40	9	29.42	1	29.909	13.1	14.1	13.1	36	18	-8	7	14.4	11.2	13.3											
May .....	29.995	30.001	30.005	30.50	8	29.50	2	30.001	26.9	27.4	27.0	38	22, 27	8	5	27.5	25.2	27.1											
June .....	29.763	29.777	29.787	30.10	21	29.18	17	29.776	38.2	41.6	37.9	54	23	30	2, 10, 18, 28	42.7	35.3	38.9											
July .....	29.604	29.609	29.618	29.92	28, 29	29.02	18	29.612	37.5	41.5	38.3	.....	.....	26	18	.....	34.1	38.9											
August .....	29.637	29.623	29.636	30.02	11, 12	29.00	23	29.632	38.8	43.7	39.2	.....	.....	32	6, 7, 9	.....	34.7	40.2											
Year and month.	Wind direction (number of times).								Wind force (number of times).										Precipitation.		Average cloudiness.		Number of days—						
	Calm.	South.	Southwest.	West.	Northwest.	North.	Northeast.	East.	Southeast.	Blank.	0	1	2	3	4	5	6	7	8	9	Blank.	Number of days.	Number of hours.	7 a. m.	2 p. m.	9 p. m.	Clear (0 to 1).	Cloudy (8 to 10).	Foggy.
1891.																													
September .....	0	1	8	7	22	26	25	0	1	0	0	3	18	16	15	13	7	16	4	0	0	7	100	49	47	46	10	10	.....
October .....	0	0	0	9	54	15	15	0	0	0	0	3	17	15	7	4	26	10	5	6	0	4	61	44	46	41	10	4	2
November .....	5	2	1	3	15	10	51	0	3	0	5	1	6	10	25	27	9	5	0	0	0	15	258	65	66	64	8	19	0
December .....	21	0	0	6	24	27	15	0	0	0	21	4	21	15	16	14	0	2	0	0	0	2	16	49	41	38	16	7	5
1892.																													
January .....	12	0	0	5	40	6	24	3	3	0	12	4	25	10	19	11	8	4	0	0	0	6	82	44	43	41	14	11	2
February .....	10	0	6	4	30	9	26	2	0	0	10	6	17	22	8	12	6	0	0	0	0	5	62	49	47	47	14	12	0
March .....	18	0	0	1	23	12	34	0	3	0	18	22	20	6	11	5	5	3	3	0	0	8	90	54	52	47	11	9	0
April .....	9	0	1	0	9	6	63	0	0	0	9	0	12	5	22	20	4	18	0	0	0	8	129	59	59	57	9	11	0
May .....	21	0	0	3	17	0	28	0	15	0	21	1	24	21	14	3	9	0	0	0	0	5	83	56	58	60	8	7	4
June .....	8	1	0	0	14	5	53	3	6	0	8	12	19	14	17	13	7	0	0	0	0	6	76	72	69	67	7	6	13
July .....	19	5	10	2	4	1	32	6	14	0	19	25	22	12	6	3	1	3	3	0	0	9	116	56	62	60	12	5	11
August .....	15	0	10	7	7	2	25	1	2	8	15	22	14	7	8	3	0	0	0	0	8	8	108	65	62	60	7	7	6

NOTE.—It is expected that the observations at this station for the years 1892, 1893, and 1894 will be received in the summer of 1894.

\* All data for August are for 23 days only.



## METEOROLOGICAL TABLES.

*Meteorological record of voluntary and other co-operating observers,  
October, 1893.*

Stations.	Temperature. (Fahrenheit.)				Precip'n.	Stations.	Temperature. (Fahrenheit.)				Precip'n.
	Max.	Min.	Mean.				Max.	Min.	Mean.		
<b>Alabama.</b>						<b>Arkansas—Cont'd.</b>					
Alico	88	32	64.4			Ashdown†	86	32	60.2		
Bermuda *†	85	34	61.3	4.64		Bee Branch†	85	32	62.4	0.45	
Birmingham†	85	48	67.0	0.55		Brinkley†	85	32	58.6	2.95	
Brewton†	89	30	64.4	6.35		Camden a†	88	35	61.9	0.65	
Carrollton *†	83	33	61.3	0.29		Camden b†	88	35	57.8	1.55	
Citronelle†	84	44	65.9	2.60		Conway *†	88	38	55.6	3.43	
Claiborne Landing†	85	31	62.2	4.30		Corning†	85	34	60.0	1.72	
Clanton†	85	31	62.2			Dallas *†	85	34	60.0	1.72	
Cordova†	84	32	62.2	0.93		Dardanelle†	87	30	59.8	1.03	
Decatur†	84	32	62.2	1.12		Fayetteville†	87	30	59.8	1.03	
Elba *†	79	42	60.9	4.77		Forrest†	88	34	63.0	0.82	
Eufaula†	95	40	69.4	2.66		Fulton†	88	34	63.0	0.71	
Eufaula c†	87	37	64.7	5.72		Gaines Landing†	88	30	61.0	0.39	
Evergreen†	87	37	64.7	5.72		Hamburg†	88	30	61.0	0.39	
Florence a†	87	30	58.6	0.45		Helena a†	86	34	61.2	0.44	
Florence b†	87	30	58.6	0.45		Helena b†	86	34	61.2	0.44	
Fort Deposit†	88	38	64.8	3.55		Hot Springs	95	32	64.0	1.05	
Gadsden†	88	38	64.8	3.55		Keesees Ferry†	91	23	57.8	0.92	
Geneva†	89	41	66.2	1.05		Kirby†	87	34	61.6	2.25	
Greensboro†	88	37	62.8	1.28		Lonoke *†	89	34	61.8	0.94	
Healing Springs†	88	35	62.6	3.10		Malvern†	84	32	58.8	0.50	
Livingston b†	88	30	62.6	0.77		Marcella†	84	32	58.2	1.38	
Lynn a†	88	30	62.6	0.60		Mount Nebo†	80	40	59.0	0.97	
Maple Grove†	91*	35	62.6	1.04		Newport a†	88	31	61.2	1.95	
Marion†	86	38	65.0	0.49		Newport b†	88	31	61.2	1.95	
Mount Willing†	85	38	64.4	3.02		Newport c†	86	29	58.4	1.97	
Newbern†	84	35	62.6	1.35		Oceola†	86	31	58.0	1.80	
Newburg†	88	24	60.6	1.24		Ozark†	95	38	62.5	1.47	
Newton†	87	37	65.1	4.42		Pine Bluff†	88	38	62.0	0.35	
Opelika†	86	30	65.0	2.10		Prescott†	86	32	64.0	0.25	
Ozark a†	86	34	62.8	1.99		Rison†	89	30	64.6	0.90	
Ozark b†	86	34	62.8	1.99		Russellville†	88	32	60.0	1.88	
Pushmataha†	90	30	62.6	5.16		Searcy†	88	30	56.1	1.63	
Rock Mills	84	39	63.4	2.31		Stuttgart†	88	31	59.7	0.49	
Scottsboro†	84	36	62.8	2.28		Texas†	91	37	64.8	0.43	
Selma a†	84	26	55.6	1.43		Washington b†	87	35	61.6	0.50	
Selma b†	84	26	55.6	1.43		Wigwag†	87	35	61.6	2.10	
Starling†	85	39	62.8	3.90		<b>California.</b>					
Stardavon†	85	39	62.8	3.90		Anaheim *†	89	54	65.2	0.00	
Talladega a†	85	32	61.2	1.50		Antioch *†	82	47	61.5	0.06	
Talladega b†	85	32	61.2	1.50		Aptos *†	75	40	57.3	0.03	
Talladega Falls†	85	32	61.2	1.50		Arcata†	69	33	50.9	4.82	
Thomasville†	87	34	63.4	2.90		Arlington Heights	95	41	62.8	1.00	
Tuscaloosa†	88	31	61.8	0.67		Athlone†	86	35	63.5	0.00	
Tusculum a†	83	31	57.6	0.59		Auburn *†	87	43	61.5	1.11	
Tusculum b†	84	29	60.3	0.57		Bakersfield a *†	79	50	63.3	0.00	
Union Springs a†	89	35	66.1	2.97		Bakersfield b†	91	40	66.6	0.00	
Union Springs b†	89	34	64.4	3.25		Ballast Point L. H.	84	37	58.8	0.22	
Uniontown†	86	40	66.2	1.92		Barstow†	84	37	58.8	0.22	
Valley Head†	84	30	57.6	1.66		Beaumont *†	89	42	66.1	1.45	
Warrior†	84	30	57.6	1.66		Belmont *†	85	45	63.2	0.00	
Wilsonville†	84	30	57.6	1.66		Berendo *†	90	45	63.8	0.00	
<b>Alaska.</b>						Berkeley†	77	45	57.4	0.52	
Killiknoo†	52	29	39.0	9.60		Bishop Creek *†	85	43	61.7	0.00	
Metlakatla†	57	18	41.2	12.66		Boca *†	85	20	47.9	0.25	
<b>Arizona.</b>						Borden *†	90	46	62.7	0.00	
Antelope Valley†	91	45	62.9	0.01		Boulder Creek *†	72	32	49.3	0.54	
Benson *†	97	40	68.5	0.00		Brentwood *†	81	44	59.3	0.00	
Buckeye†	97	40	68.5	0.00		Brighton *†	95	43	65.4	0.00	
Calabasas†	95	33	60.1	0.00		Byron *†	83	40	59.7	0.00	
Casa Grande *†	90	55	70.9	0.00		Caliente *†	85	40	61.4	0.10	
Crittenden *†	95	36	62.8	0.05		Calistoga *†	86	38	59.3	0.51	
Dragoon Summit†	94	54	72.0	0.01		Campo Seco†	86	40	57.0	0.11	
Dudleyville†	93	40	66.3	0.00		Capitola *†	86	40	57.0	0.00	
Farley's Camp†	82	54	65.0	0.25		Castroville *†	74	41	56.2	0.05	
Flagstaff *†	76	23	48.3	0.04		Centerville *†	87	40	59.7	0.23	
Fort Apache†	79	27	53.7	0.04		Chico *†	90	40	59.3	0.00	
Fort Bowie†	85	42	63.9	0.04		Chino *†	89	46	60.8	1.47	
Fort Grant†	86	39	63.2	0.08		Cisco *†	84	20	44.7	0.00	
Fort Huachuca†	86	36	61.5	0.00		Citrus *†	86	40	60.6	0.04	
Fort Mohave†	88	48	67.6	0.02		Claremont†	87	40	60.6	0.00	
Gila Bend b *†	101	47	70.8	0.02		Cloverdale *†	84	41	63.0	0.06	
Holbrook†	88	48	67.6	0.02		Colegrove†	84	41	63.0	0.06	
Lochiel *†	80	26	53.9	0.03		Colfax *†	76	38	58.9	1.23	
Maricopa *†	82	42	58.6	0.00		Colton†	90	42	64.0	0.18	
Mount Huachuca†	100	50	73.8	0.00		Colusa†	80	37	59.4	0.05	
Natural Bridge†	81	38	61.8	0.06		Corning *†	85	40	61.8	0.00	
Oracle†	83	42	62.9	0.05		Crescent City†	88	47	65.4	0.95	
Pantano *†	89	49	66.1	0.00		Crescent City L. H.	88	47	65.4	0.95	
Parker†	90	39	68.5	0.00		Crofton *†	84	44	59.1	0.10	
Payson *†	78	34	52.2	0.40		Davisville a *†	85	45	63.9	0.00	
Phenix†	95	39	65.4	0.00		Delano *†	85	45	63.9	0.00	
Red Rock *†	95	52	72.8	0.03		Delta *†	83	40	61.4	0.15	
Reynolds†	90	46	67.8	0.00		Dinuba *†	84	40	62.4	0.15	
St. Helena R'h *†	95	44	66.0	0.00		Downey *†	96	50	65.9	0.77	
San Carlos†	89	32	63.2	0.00		Dry Creek *†	94	46	66.2	1.03	
San Simon *†	93	43	67.9	0.00		Duarte†	88	40	61.9	1.15	
Show Low†	92	42	65.8	0.09		Dunnigan *†	74	32	50.1	0.22	
Signal†	97	51	72.0	0.00		Edgwood *†	67	24	45.6	0.76	
Texas Hill *†	92	42	65.8	0.09		Edmonton *†	73	29	47.6	1.27	
Tucson a†	93	44	67.2	0.00		Eldorado *†	86	40	59.4	0.65	
Tucson b†	91	51	70.4	0.00		Elmira *†	88	40	60.2	0.18	
Walnut Grove†	82	36	58.1	0.03		El Verano *†	80	37	58.4	0.35	
Whipple Barracks†	82	24	50.8	0.15		Emigrant Gap *†	70	30	48.7	2.00	
Willcox *†	80	42	64.5	0.00		Esparto *†	86	40	63.0	0.07	
Yuma *†	101	62	79.9	0.00		Evergreen†	82	43	62.9	0.00	
<b>Arkansas.</b>						Exeter *†	82	43	62.9	0.00	
Arkadelphia†	82	43	62.9	1.43		Fall Brook *†	92	43	59.6	0.86	

*Meteorological record of voluntary observers, &c.—Continued.*

Stations.	Temperature. (Fahrenheit.)			Precip'n.	Stations.	Temperature. (Fahrenheit.)			Precip'n.
	Max.	Min.	Mean			Max.	Min.	Mean	
California—Cont'd.	°	°	°	Ins.	California—Cont'd.	°	°	°	Ins.
Farmington *†	84	40	63.0	0.00	Palm Springs *†	96	58	75.8	0.00
Felton *†	92	30	62.0	0.68	Pasadena	87	40	59.6	0.71
Fernando *†	82	45	62.2	0.61	Paso Robles *†	88	34	54.4	0.24
Florence *†	82	32	64.2	0.00	Petaluma *†	85	39	58.0	0.19
Florin *†	82	32	57.8	0.00	Piedras Blancas L.H.	80	34	55.3	0.11
Folsom City a *†	88	45	63.7	0.63	Pigeon Point L. H.	80	34	55.3	0.38
Folsom City b *†	84	42	60.6	0.23	Placerville a *†	80	34	55.3	0.95
French Corral	82	41	59.6	1.06	Placerville b†	76	30	49.8	0.90
Fresno *†	80	51	63.7	T.	Pleasanton a *†	88	32	54.5	0.05
Fruto *†	90	42	63.9	0.00	Pleasanton b†	86	26	54.5	0.03
Galt *†	83	36	60.7	0.00	Pt. Ano Nuevo L. H.	80	34	55.3	0.10
Georgetown†	77	33	55.8	1.60	Point Arena L. H.	80	34	55.3	0.10
Gilroy *†	88	40	60.0	0.02	Point Bonita L. H.	80	34	55.3	0.10
Girard *†	75	35	54.9	0.12	Pt. Conception L. H.	80	34	55.3	0.10
Glendora†	86	35	58.1	0.51	Point Fermin L. H.	80	34	55.3	0.10
Glen Ellen *†	86	35	58.1	0.51	Pt. Hueneme L. H.	80	34	55.3	0.10
Goshen†	86	42	63.9	0.00	Point Lobos	70	45	54.8	0.28
Grass Valley a	88	30	54.6	0.35	Point Loma L. H.	80	34	55.3	0.10
Grass Valley b	88	30	54.6	0.35	Point Montara L. H.	80	34	55.3	0.10
Gridley *†	88	30	54.6	0.35	Point Pinos L. H.	80	34	55.3	0.10
Haywards *†	70	28	55.0	0.23	Point Reyes L. H.	80	34	55.3	0.10
Headlands†	84	38	58.6	0.42	Point Sur L. H.	80	34	55.3	0.10
Hendersons' R'ch.	89	37	56.9	0.04	Pomona *†	90	45	60.2	0.00
Hollister *†	89	37	56.9	0.04	Porterville a *†	90	46	63.3	0.00
Hornbrook *†	75	30	50.3	1.60	Port Los Angeles *†	73	57	64.5	1.03
Humboldt L. H.	89	45	66.0	0.00	Poway *†	86	46	55.8	0.19
Huron *†	89	45	66.0	0.00	Puente *†	89	49	64.9	1.05
Hydenville†	70	38	53.4	3.23	Ravenna *†	86	43	59.8	0.25
Independence†	84	32	57.5	0.00	Red Bluff *†	90	48	63.7	0.25
Indio *†	102	48	72.4	0.00	Redding a *†	85	35	60.2	0.27
Ione *†	87	35	60.2	0.13	Redding b†	89	37	60.2	0.39
Iowa Hill *†	80	40	57.4	1.35	Redland a b *†	88	42	62.2	1.00
Jackson.	75	36	54.6	0.50	Represa†	82	40	60.3	0.26
Jolon	85	33	54.3	2.20	Rio Vista	83	40	60.3	0.28
Julian†	79	46	60.8	T.	Rocklin *†	86	42	64.9	0.09
Keeler *†	82	35	54.8	0.35	Roe Island L. H.	80	34	55.3	0.10
Keene *†	82	35	54.8	0.35	Sacramento a†	75	30	51.4	0.09
Kennedy Gold Mine†	82	40	55.8	T.	Sacramento b *†	82	43	59.8	0.00
King City *†	92	30	57.4	0.00	Sacramento c *†	76	42	58.9	0.10
Kingsburg *†	85	40	65.3	0.00	Salinas b *†	76	40	56.6	0.02
Knights Landing *†	90	35	62.4	0.08	Salton *†	102	54	79.4	0.00
Lagrange *†	88	40	63.0	0.12	San Ardo a *†	88	35	54.2	0.00
Lathrop *†	82	40	58.6	0.00	San Ardo b†	92	32	59.6	T.
Laurel *†	86	38	56.7	0.35	San Bernardino	91	40	60.6	1.05
Lemoore a *†	89	38	61.1	0.00	San Gabriel *†	93	49	64.5	0.50
Lick Observatory†	72	33	51.0	0.66	Sanger Junction *†	90	38	62.8	0.00
Lime Point L. H.	82	35	59.2	0.26	San Jacinto†	93	36	59.2	0.66
Livermore *†	82	38	59.2	0.00	San Jose a *†	81	41	58.6	0.00
Livingston *†	86	48	64.9	0.00	San Jose b†	78	30	54.6	0.01
Lodi	81	34	58.9	T.	San Luis L. H.	78	30	54.6	1.80
Long Beach *†	94	46	62.9	0.00	San Luis Obispo	80	34	55.3	0.82
Los Angeles *†	94	48	62.8	0.70	San Mateo *†	82	44	59.3	0.14
Los Banos *†	84	47	59.3	0.05	San Miguel *†	85	38	58.0	0.14
Los Gatos a *†	86	48	58.1	0.35	San Pedro *†	90	53	66.2	0.63
Los Gatos b†	82	38	58.0	0.31	Santa Ana *†	87	50	65.5	2.14
Mammoth Tank *†	96	58	74.7	0.00	Santa Barbara a†	88	44	61.5	0.82
Mare Island L. H.	80	34	55.3	0.10	Santa Barbara b *†	92	48	61.8	0.62
Mariposa *†	73	38	56.3	0.01	Santa Barbara L. H.	80	34	55.3	0.94
Martinez *†	86	40	54.3	0.13	Santa Clara a *†	85	38	56.3	0.04
Marysville a *†	88	40	59.8	0.34	Santa Clara b†	82	44	57.6	0.45
Menlo Park *†	82	40	58.1	0.09	Santa Cruz a *†	85	39	58.4	0.75
Merced *†	88	40	60.4	0.00	Santa Cruz b†	82	39	58.4	0.46
Middletown *†	86	34	55.9	0.36	Santa Cruz L. H.	80	34	55.3	0.70
Mills College	80	34	55.9	0.16	Santa Margarita *†	88	41	61.7	0.65
Milton (near) *†	85	46	62.6	0.02	Santa Maria†	88	38	57.2	1.00
Modesto *†	89	51	62.7	0.00	Santa Monica *†	71	47	58.5	0.88
Mohave *†	84	42	60.3	0.29	Santa Paula *†	88	48	61.8	0.88
Mokelumne Hill *†	84	42	55.2	0.40	Santa Rosa *†	83	37	58.7	0.88
Monson *†	87	40	61.9	0.00	Saticoy	88	44	62.2	0.00
Montague *†	72	37	55.0	0.44	Selma *†	88	44	62.2	1.25
Monterey *†	80	34	56.4	0.05	Shasta Springs†	75	30	50.0	0.20
Monterey (Hotel del Monte) *†	79	35	55.4	0.00	Shingle Springs *†	73	36	51.2	0.40
Mount Glenwood *†	84	42	64.3	0.00	Sisson *†	67	32	46.4	0.61
Mutch Flat	81	39	57.5	0.28	Sneddens Ranch	84	37	57.1	0.72
Napa City a *†	84	38	56.3	0.17	Soledad *†	82	36	53.8	0.27
Napa City b†	81	39	57.5	0.18	Sonoma *†	84	36	53.8	0.27
National City†	91	47	62.6	0.33	Soquel *†	78	43	59.4	0.20
Needles a†	92	49	69.8	0.00	SE. Farrallon L.H.	80	34	55.3	0.00
Needles b†	91	47	62.6	0.33	Spadra *†	87	47	62.2	0.00
Nevada City†	77	31	51.7	1.25	Stockton a	80	38	58.4	0.00
New Almaden *†	83	40	59.5	0.10	Stockton b *†	84	46	62.5	0.03
Newark *†	84	42	63.2	0.24	Summit *†	63	21	45.5	0.30
Newcastle a†	82	38	59.4	0.61	Suisun City *†	89	41	62.3	0.74
Newcastle b *†	86	40	60.3	0.17	Susanville *†	70	26	46.8	0.60
Newhall *†	91	39	61.1	0.72	Sutter Creek *†	78	37	53.4	0.30
Newman *†	82	45	61.0	0.00	Tehachapi a *†	80	34	55.3	0.50
Niles *†	80	40	55.5	0.44	Tehachapi b†	82	32	50.9	0.27
Nordhoff†	93	37	59.9	0.61	Tehama *†	80	43	60.8	0.03
Norwalk *†	86	48	62.4	1.74	Templeton *†	88	35	56.3	0.35
Oakdale *†	76	33	55.6	0.20	Towles *†	75	32	53.4	1.70
Oakland a	87	43	57.6	0.29	Tracy *†	82	42	61.5	0.00
Oakland b *†	74	43	58.3	0.20	Traver *†	85	60	69.0	0.00
Ogilby *†	96	55	71.7	0.00	Trinidad L. H.	80	34	55.3	4.33
Oleta *†	78	37	56.2	0.38	Tropico *†	90	48	64.4	0.81
Ontario *†	80	50	65.8	1.38	Truckee *†	78	34	47.3	0.38
Oranvale†	83	38	60.4	0.06	Tulare a *†	83	45	59.8	0.00
Orland *†	90	40	67.3	0.43	Tulare b†	80	34	55.3	0.00
Orville a *†	84	54	68.6	0.10	Tulare c.	100	32	62.8	0.00
Orville b†	88	43	67.6	0.20	Turlock a *†	87	45	65.5	0.00
Pajaro *†	81	39	59.0	0.14	Turlock b *†	82	28	52.3	T.
Palo Alto†	88	32	57.8	0.34	Ukiah†	76	34	53.2	0.64
					Upper Lake	88	32	56.7	0.47

Meteorological record of voluntary observers, &amp;c.—Continued.

Stations.	Temperature. (Fahrenheit.)			Precip'n.	Stations.	Temperature. (Fahrenheit.)			Precip'n.
	Max.	Min.	Mean			Max.	Min.	Mean	
California—Cont'd.				Ins.	Connecticut—Cont'd.				Ins.
Upper Mattole*1	82	58	56.6	3.65	New Hartford a*1	82	24	54.0	5.97
Vacaville a*1	86	43	62.0	0.20	New Hartford b.	82	24	54.0	5.97
Vacaville b*1	86	43	61.1	0.05	North Franklin	74	25	51.5	4.55
Valley Springs*1	80	48	63.4	0.00	N. Grosvenor Dale.	76	25	52.4	5.10
Ventura*1	84	47	60.6	0.83	Norwalk b.	76	25	52.4	4.62
Vina*1	89	45	64.6	0.02	South Manchester	75	25	51.6	5.31
Volcano Springs*1	102	51	60.5	0.00	Stevens	75	25	51.6	6.71
Walnut Creek	91	38	74.5	0.18	Storrs	75	25	51.6	6.71
West Butte	87	37	63.4	0.10	Thompson	75	24	51.6	3.83
Westley*1	90	44	63.4	0.00	Voluntown*1	73	25	52.8	4.87
Wheatland	84	38	60.4	0.28	Wallingford	78	27	54.8	5.01
Whittier*1	80	51	65.1	1.00	Waterbury	78	27	54.8	5.01
Williams*1	85	39	61.0	0.08	West Simsbury	78	27	54.8	5.01
Willows a*1	81	37	58.2	0.00	Delaware.				
Willows b*1	85	43	63.3	0.00	Dover*1	80	31	56.2	4.37
Winchester*1	100	35	62.4	0.53	Kirkwood*1	80	31	56.2	4.37
Winters*1	85	44	64.8	0.03	Milford	82	30	57.2	3.87
Woodland*1	82	40	59.6	0.08	Millsboro*1	81	29	55.8	2.88
Yerba Buena L. H.	79	25	48.4	0.22	Seaford*1	80	28	56.6	3.12
Yreka*1	70	25	48.4	0.54	District of Columbia.				
Yuba City*1	79	48	62.4	0.25	Dist'ng Reserv*1	76	28	55.8	3.30
Colorado.					Rec'ng Reserv*1	77	29	55.7	4.36
Akron*1	79	19	51.5	0.07	West Washington*1	84	26	58.1	3.91
Alma*1	81	12	35.9	0.35	Florida.				
Arboles				T.	Amelia*1	85	49	69.8	3.90
Avoca				0.42	Archer*1	91	43	73.0	1.28
Boulder*1	78	31	51.7	1.16	Avon Park*1	89	64	75.0	2.29
Breckenridge*1	71	16	36.8	2.15	Bristol*1	92	46	74.0	3.15
Brush*1	84	18	49.2	0.65	Brooksville*1	88	51	71.2	0.94
Byers*1	70	40	55.3	0.00	Clermont*1	93	56	72.5	1.72
Canyon*1	84	20	53.1	0.00	Eustis*1	92	52	71.4	4.35
Castle Rock*1	80	10	47.4	0.57	Federal Point*1	89	52	70.6	7.87
Cheyenne Wells*1	79	35	48.5	T.	Fort Meade*1	90	55	73.5	2.18
Climax*1	60	9	26.0	3.00	Gainesville*1	87	46	73.4	2.97
Collbran				0.26	Grasmere*1	91	56	73.4	5.24
Como (near)*1	63	10	37.0	0.25	Green Cove Sp'ge*1	88	45	69.2	6.74
Cope*1	83	21	51.2	0.20	Homeland*1	93	55	72.6	4.02
Deer Trail*1	80	24	53.6	0.35	Kissimmee*1	91	60	75.4	4.42
Delta*1	78	19	48.6	0.00	Lake City*1	90	48	71.1	2.33
Downing*1	85	10	50.0	0.65	Manatee*1	90	55	74.0	0.14
Dumont	72	24	45.1	0.02	Merritt Island*1	88	61	76.8	2.84
East Dale				0.02	Moseley Hall*1	88	61	73.4	1.50
First View*1	84	20	53.3	T.	Mullet Key*1	86	61	73.4	1.50
Glen Eyrie*1	73	20	48.0	0.39	Myers*1	88	61	73.4	1.50
Glenwood Sp'ge*1	75	20	49.2	0.45	New Smyrna*1	89	58	74.2	1.04
Gold Hill*1	79	27	49.6	1.35	Ocala*1	88	55	71.1	2.66
Grand Junction*1	75	30	52.3	0.80	Orange City*1	88	55	74.0	9.02
Greeley*1	74	20	49.8	0.11	Oxford*1	88	53	71.0	3.47
Gunnison*1	84	5	38.2	T.	Plant City*1	88	53	71.0	3.47
Hugo*1	84	20	48.8	T.	Saint Francis B'ks	91	54	73.6	1.83
Hugo (near)*1	81	18	47.8	0.16	Saint Petersburg*1	91	54	74.2	2.15
Husted*1	85	9	49.2	0.32	Tallahassee*1	84	41	67.1	2.88
Idaho Springs*1	72	25	46.6	0.38	Tarpon Springs*1	88	57	74.2	1.32
Julesburg*1	85	10	50.0	0.14	Georgia.				
Kit Carson*1	85	41	61.0	0.00	Adairsville*1	86	26	60.7	0.54
La Jara*1	75	18	47.0	0.22	Alapaha*1	88	36	67.5	1.56
Lamar*1	90	24	55.2	0.11	Albany*1	87	37	67.1	0.48
Las Animas*1	85	23	54.9	0.02	Americus*1	88	37	65.8	2.14
Lavender*1	75	11	42.0	0.25	Athens*1	79	33	61.0	0.92
Lay*1	71	10	41.2	0.62	Athens*1	79	33	61.7	0.92
Le Roy*1	80	19	49.3	0.41	Bainbridge*1	88	38	68.0	2.13
Leslie				0.50	Blakely*1	85	41	66.8	2.49
Loveland				0.12	Brant*1	85	41	66.8	2.49
McCoy*1				0.53	Camak*1	89	31	66.8	3.00
Manhattan*1				T.	Camilla	87	39	66.8	3.00
Middle Box Elder.				0.10	Canton*1	78	24	55.0	0.53
Minneapolis*1	90	24	55.0	0.37	Clayton*1	78	24	55.0	0.53
Monte Vista*1	71	17	43.0	T.	Cohutta	90	37	65.9	1.43
Moraine*1	66	15	43.8	0.43	Columbus*1	86	30	66.9	2.57
Pagoda (near)*1	79	17	48.5	1.35	Cordele*1	86	34	66.9	1.92
Paonia*1	80	22	48.0	0.15	Covington	82	30	64.0	0.80
Parachute*1	74	22	48.0	0.15	Dahlonega*1	82	30	64.0	0.80
Red Cliff				0.23	Darien*1	95	51	74.4	5.05
Rico.				0.60	Dublin*1	89	34	70.3	1.53
River Bend*1	80	30	53.0	0.25	Eastman*1	86	36	64.2	1.55
Rocky Ford*1	80	30	53.0	0.25	Elberton*1	86	33	63.1	2.38
Saint Cloud				0.00	Fleming*1	90	33	65.3	2.45
Sanborn				0.30	Forney*1	92	42	67.2	2.55
San Luis*1	78	19	46.0	0.35	Fort Gaines*1	96	30	65.2	3.31
Seibert*1				1.96	Gainesville*1	88	40	69.4	0.45
Smoky Hill Mine*1	77	11	47.2	0.70	Gillsville*1	88	40	69.4	0.45
Springfield				0.15	Griffin*1	80	32	57.8	1.41
Stanford*1	86	19	39.9	0.70	Hephzibah*1	80	40	63.8	5.11
Steamboat Spring*1	77	14	46.4	1.25	Homerville*1	82	41	68.0	3.28
Sunnyside	78	7	38.9	0.36	Lafayette*1	82	24	59.4	1.20
Surface Creek*1	76	8	45.5	0.66	Lawrenceville*1	86	34	63.2	0.94
Table Rock				0.49	Louisville*1	87	33	65.9	2.94
Thon*1	77	24	51.2	0.55	Lumpkin*1	87	37	67.2	2.26
T. S. Ranch*1				1.14	McArthur*1	86	56	75.0	2.72
Twin Lakes				0.20	Macon*1	86	56	75.0	2.72
Vilas				0.61	Marion*1	82	39	59.2	0.51
Watkins*1	92	28	55.2	0.40	Marion*1	82	39	59.2	0.51
Wildcat				0.13	Marshallville*1	85	36	67.0	1.08
Yuma				0.40	Milledgeville*1	84	33	64.6	1.10
Zuck				0.13	Monticello*1	85	35	65.4	1.43
Connecticut.					Morgan*1	87	36	64.4	2.50
Bridgeport*1	75	30	54.4	4.83	Newman*1	84	52	61.0	0.35
Canton	73	23	53.2	5.92	Piscataway*1	88	41	68.3	0.30
Colchester	75	23	54.1	6.00	Point Peter*1	70	33	62.4	1.70
Falls Village				3.99	Poulan*1	70	33	62.4	1.70
Greenfield Hill				4.93	Quitman*1	88	40	67.4	1.80
Hartford b.				4.72					
Hartford c.	76	29	53.4	5.36					
Lebanon				5.36					
Middletown	75	22	54.0	5.54					

Meteorological record of voluntary observers, &amp;c.—Continued.

Stations.	Temperature. (Fahrenheit.)			Precip'n.	Stations.	Temperature. (Fahrenheit.)			Precip'n.
	Max.	Min.	Mean			Max.	Min.	Mean	
Georgia—Cont'd.					Indiana—Cont'd.				
Resaca†	82	28	58.5	1.05	Princeton† <sup>1</sup>	83	25	54.2	2.96
Reynolds†	88	34	62.8	2.46	Rockville†	84	18	54.2	1.93
Rome† <sup>1</sup>	84	28	58.5	0.93	Rushville†	84	28	55.8	3.23
Talbotton†	80	38	68.6	1.97	Seymour†	84	28	55.8	4.71
Thomasville†	90	38	68.6	3.24	Terre Haute†	85	21	57.2	2.21
Tooea†	82	32	61.6	1.00	Union City†	86	20	53.8	1.75
Union Point†	82	31	62.6	1.26	Valparaiso†	82	20	50.8	3.45
Washington†	83	33	63.0	2.30	Vevay†	86	28	55.8	2.40
Way Cross†	87	40	68.2	4.31	Worthington†	81	22	54.6	3.03
Waynesboro†	89	33	65.2	4.02	Indian Territory.				
West Point†	84	40	65.8	1.99	Gwendale†	89	42	66.5	0.00
Whitesburg†	84	40	65.8	1.65	Kemp†	93	34	65.6	0.26
Idaho.					Lehigh†	93	25	62.7	0.45
Boise Barracks	75	24	47.2	0.84	Purcell†	94	32	65.2	0.00
Bozeman City†	72	10	44.1	2.89	Iowa.				
Fort Sherman	65	28	45.0	5.50	Algona <sup>*1</sup>	85	15	49.1	0.02
Garden Valley† <sup>1</sup>	70	28	45.3	3.02	Alta† <sup>1</sup>	85	15	49.9	0.23
Grangeville	65	26	44.0	5.57	Amana†	82	19	51.8	3.02
Kootenai† <sup>1</sup>	62	21	40.9	2.50	Ames†	87	15	51.0	0.85
Lake†	68	15	41.5	0.20	Ames†	87	15	51.0	0.85
Martin†	65	3	39.8	0.02	Ames (near) <sup>*1</sup>	88	20	54.6	0.52
Oakley†	80	22	48.1	0.26	Audubon	84	18	52.0	0.18
Paris†	77	19	44.8	0.93	Belle Plaine <sup>*1</sup>	84	17	51.0	2.67
Payette†	72	24	47.0	0.67	Blakeville† <sup>1</sup>	86	18	53.6	4.23
Illinois.					Bonaparte† <sup>1</sup>	91	23	53.9	1.15
Aurora†	83	15	50.8	3.20	Carroll†	87	18	51.0	0.10
Beardstown†	82	15	51.0	0.40	Cedar Falls†	85	15	53.1	3.53
Bloomington†	89	17	55.5	0.74	Cedar Rapids†	80	23	52.6	2.63
Bushnell†	88	19	56.7	1.69	Centerville†	81	25	54.3	1.30
Carlisle†	89	24	56.6	0.51	Charles City†	84	13	52.5	1.28
Carlyle				0.49	Clarinda† <sup>1</sup>	80	26	53.7	0.00
Cordova	82	15	51.0	1.05	Clinton†	82	18	51.3	0.68
Dixon† <sup>1</sup>	86	26	55.8	2.22	Corning† <sup>1</sup>	84	21	54.2	0.22
Dubuois† <sup>1</sup>	84	17	54.4	0.27	Council Bluffs	86	23	54.5	0.00
East Peoria† <sup>1</sup>	90	16	53.4	1.06	Cresco† <sup>1</sup>	81	14	48.2	3.49
Effingham†	81	21	50.6	1.19	Decorah†	82	14	50.8	2.13
Fort Sheridan†	83	19	53.0	0.40	Delaware <sup>*2</sup>	83	19	48.3	3.27
Galva†	86	31	58.9	4.63	Des Moines (near)† <sup>1</sup>	85	24	55.8	0.48
Goldconda†	92	23	55.6	0.43	Elkader† <sup>1</sup>	85	16	50.5	3.23
Greenville† <sup>1</sup>	90	22	56.2	0.39	Emmetsburg†	85	10	49.8	0.15
Griggsville†	86	24	56.8	0.22	Fort Madison† <sup>1</sup>	84	28	57.4	0.35
Havana†	85	16	52.8	0.95	Fulton† <sup>1</sup>	82	16	52.2	0.12
Hennepin†	79	22	51.6	1.70	Galva† <sup>1</sup>	86	16	50.4	0.06
Jordans Grove†	84	30	57.1	6.55	Glenwood†	94	24	58.4	0.22
Kankakee†	84	19	53.0	0.52	Grand Meadow <sup>*1</sup>	80	22	50.4	3.02
Lagrange†	82	20	54.9	1.30	Greenfield† <sup>1</sup>	86	21	51.2 <sup>b</sup>	0.23
Martinsville†	86	28	54.4	3.00	Grinnell†	85	22	55.1	1.50
Mascoutah <sup>*2</sup>	83	35	59.9	0.20	Grundy Center†	85	16	50.1	2.22
Mattoon <sup>*1</sup>				3.18	Hampton†	84	13	48.6	1.63
Mount Carmel†	88	22	57.0	1.11	Hopkinton <sup>*2</sup>	79	25	53.2	0.21
Mount Pulaski	84 <sup>3</sup>	33 <sup>3</sup>	57.8 <sup>3</sup>	3.56	Humboldt†				0.10
Muddy Valley <sup>*2</sup>	83	21	56.9	2.22	Independence†	83	18	53.1	3.65
Olney <sup>*1</sup>	86 <sup>2</sup>	22	53.2 <sup>d</sup>	1.97	Indianola†	89	20	57.5	0.20
Oley <sup>*1</sup>	84	18	53.3	1.10	Iowa City†	83	19	54.3	1.98
Oregon†	80	19	50.4	2.28	Iowa Falls†	85 <sup>3</sup>	11 <sup>3</sup>	49.0 <sup>3</sup>	0.89
Oswego† <sup>1</sup>	85	17	56.0	1.10	Jefferson† <sup>d</sup>	85	20	55.1	0.45
Ottawa† <sup>1</sup>	83	20	54.6	3.37	Keosauqua†	80	23	57.1	1.08
Palestine† <sup>1</sup>	89	23	55.9	0.28	Knoxville	87	22	54.2	1.50
Pana <sup>*1</sup>	85	19	54.6	1.41	Larrabee†	80	13	49.0	0.89
Paris†				0.97	Le Claire†				0.36
Peoria†	86	23	56.0	0.70	Logan†	88	22	55.9	0.25
Peoria† <sup>1</sup>	85	15	54.2	0.65	Maquoketa†				0.78
Quincy†				0.38	Marshall†	85	16	53.6	0.62
Rantoul <sup>*2</sup>	84	22	52.6	0.76	Mason City†	73 <sup>b</sup>	20 <sup>b</sup>	48.6 <sup>b</sup>	1.63
Riley†	79	21	50.6	2.47	Maxon† <sup>1</sup>	89	23	53.7	1.92
Rockford <sup>*1</sup>	80	28	53.0	3.60	Mechanicsville	79	20	50.5	1.70
Rushville	91	22	57.4	0.22	Monticello <sup>*1</sup>	81	16	49.8	2.08
Saint John <sup>*2</sup>	87	35	55.8	2.58	Mount Pleasant†	82		53.0	0.17
Seymour <sup>*1</sup>	76	23	51.0	1.13	Mount Vernon <sup>*1</sup>	75	22	53.1	4.12
Walcutt†	86	20	55.4	0.23	Murray†				0.05
Warsaw				0.22	Newton	87	18	53.2	1.17
White Hall <sup>*1</sup>	84	22	51.5	1.30	Ossage <sup>*1</sup>				1.69
Winnebago† <sup>1</sup>	77 <sup>d</sup>	20 <sup>d</sup>	49.0 <sup>d</sup>	2.45	Oskaloosa† <sup>1</sup>	88	20	52.7	1.20
Indiana.					Ovid <sup>*1</sup>	88	23	53.2	1.32
Angola				2.55	Panama†	89	21	53.1	0.10
Ashboro†	84	22	56.1	3.05	Richland <sup>*1</sup>	88	25	53.8	1.64
Bedford†	85	24	55.5	6.18	Rock Rapids	80	15	47.5	1.05
Butterville†	85	22	54.8	5.32	Seymour†	88	15	53.7	1.20
Cambridge City†	78	21	53.6	3.58	Spirit Lake†	83	12	49.0	1.35
Columbia City <sup>*1</sup>	78	26	50.5	2.68	Storm Lake†	81	17	51.7	0.10
Columbus	82	28	55.0	4.44	Tipton†	80 <sup>d</sup>	21 <sup>d</sup>	48.7 <sup>d</sup>	1.71
Connorsville†	79	23	52.8	3.02	Villisca† <sup>1</sup>	80	10	53.2	0.74
Decatur Springs <sup>*2</sup>	82	27	56.4	4.29	Vinton <sup>*1</sup>	82	20	51.5	2.57
Delphi	81	18	51.0	1.82	Washington <sup>*1</sup>	88	23	54.9	1.15
Evansville†				4.38	Webster City <sup>*1</sup>	86	22	50.3	0.50
Farmland†	81	22	51.0	1.41	Williams†	84	11	49.7	1.06
Franklin†	80	24	52.9	3.37	Winterset†	86	22	54.8	0.15
Hawpatch <sup>*1</sup>	79	25	50.5	2.33	Kansas.				
Huntingburg <sup>*1</sup>	83	30	56.5	9.00	Achille† <sup>1</sup>	95	30	58.9	0.84
Jasper†	82	32	56.4	4.16	Achilles† <sup>1</sup>	87	25	44.8	0.77
Jeffersonville†	81	28	55.8	4.93	Allison <sup>*1</sup>	82	25	49.8	0.25
Kokomo† <sup>1</sup>	82 <sup>b</sup>	22 <sup>b</sup>	56.8 <sup>b</sup>	2.08	Altونا† <sup>2</sup>	86	33	54.2	0.33
Lacoma† <sup>1</sup>	84	23	56.5	5.03	Atchison†	89	27	58.4	0.11
Lafayette†	85	17	54.3	1.57	Beloit†	87	31	56.7	0.31
Logansport†				2.71	Bucklin				T.
Logansport <sup>b</sup>	79	23	53.4	1.85	Cawker City <sup>*1</sup>	86	28	56.4	0.10
Madison <sup>b</sup>	84	25	57.8	5.47	Colby†	86	23	52.6	0.24
Marengo	86	20	56.0	8.75	Coldwater†	88	28	57.8	0.12
Marion†	86	25	57.1	2.15	Collyer <sup>*1</sup>	99	40	66.6	0.00
Markle†	82	18	51.8	2.25	Columbus†	92	29	60.0	1.00
Mauzy	79	20	52.4	3.54	Cunningham† <sup>1</sup>	91	28	55.6	T.
Mount Vernon	83	25	55.5	3.27	Downs				0.17
Muncie†	84 <sup>3</sup>	30 <sup>3</sup>	57.3 <sup>3</sup>	6.12	Eldorado†	90	29	60.5	T.
New Albany <sup>*1</sup>	81	29	58.4	4.46	Elk City <sup>*1</sup>	90	31	59.8	0.25



## Meteorological record of voluntary observers, &amp;c.—Continued.

Stations.	Temperature. (Fahrenheit.)			Precip'n.	Stations.	Temperature. (Fahrenheit.)			Precip'n.
	Max.	Min.	Mean			Max.	Min.	Mean	
<b>Kansas—Cont'd.</b>					<b>Louisiana—Cont'd.</b>				
Emporia†	85	31	57.0	0.00	Lawrence†	86	49	68.0	
Englewood†	93	24	59.3	0.13	Liberty Hill†	97	34	67.4	
Eureka Ranch†	89	25	53.6	T.	Maurepas†	90	36	66.0	
Fort Riley†	90	35	53.6	0.25	Melville†	91	44	68.2	
Garden City†	83	25	52.9	T.	Minden†	94	35	65.6	
Gibson†	88	26	51.0	T.	Monroe†	90	36	60.6	
Gove City†	92	29	53.5	0.39	Natchitoches†	90	34	62.5	
Grainfield†	84	36	61.6	0.50	New Iberia†	88	43	66.6	
Grenola†	92	30	57.2	0.25	Opelousas†	88	40	66.0	
Grinnell†	95	30	53.8	0.25	Oxford†	97	29	62.6	
Halstead†	86	26	56.2	0.06	Paincourtville†	89	36	64.5	
Horton†	86	27	56.8	0.15	Plaquemine†	86	41	70.5	
Hutchinson†	92	30	61.1	0.09	Rayne†	91	32	65.2	
Independence†	92	31	58.8	0.25	Roseland†	89	36	65.8	
Kiowa†	92	31	59.4	0.10	Schriever†	89	36	65.8	
Lebo†	88	26	57.6	0.46	Shell Beach†	85	44	66.7	
Leoti†	85	21	52.6	0.01	Sugar Ex. Station†	85	42	66.8	
McPherson†	88	29	57.4	0.00	Sugartown†	88	34	62.8	
Manhattan†	95	24	55.4	0.71	Thibodeaux†	85	42	66.8	
Manhattan†	90	26	52.8	0.73	Wallace†	85	42	66.8	
Mankato†	89	18	55.3	0.12	West End†	89	32	63.2	
Marion†	90	28	55.1	0.48	Winnfield†	98			
Marmaton†				0.60	Winnboro†				
Medicine Lodge†	92	29	56.8	0.44	<b>Maine.</b>				
Minneapolis†	88	28	52.4	T.	Bar Harbor†	69	30	51.2	
Monument†	90	25	53.5	0.15	Belfast†	66	32	50.2	
Morland†	86	25	53.5	0.54	Calais†	71	23	49.0	
Morton†	91	32	59.8	T.	Cornish†	74	25	49.4	
Mount Hope†				0.70	East Machias†	67	27	48.3	
Olathe†	90	28	58.0	0.15	Easton†	80	20	48.3	
Osage†	93	22	59.2	1.82	Fairfield†	72	25	50.2	
Phillipsburg†	86	30	55.0	1.10	Farmington†	80	19	49.6	
Pleasant Dale†	87	28	54.5	0.18	Fort Kent†	70	16	44.8	
Quinter†	81	37	54.8	0.10	Gardiner†	72	26	49.6	
Rome†	90	33	59.4	0.00	Houlton†	76	22	48.2	
Sedan†	90	32	59.8	T.	Lewiston†	78	25	50.5	
Sharon Springs†				0.00	Mattawamkeag†	71	25	48.0	
Sterling†	97	30	60.0	T.	Mayfield†	73	20	46.8	
Topeka†	90	28	59.8	0.10	Orono†	74	24	47.9	
Tribune†	86	26	51.9	T.	Petit Menan†	60	32	49.9	
Wa. Keeney†	84	38	54.9	T.	West Jonesport†	64	27	48.4	
Wakefield†	96	32	58.5	1.09	<b>Maryland.</b>				
Wallace†				0.00	Bachmans Val.†	76	30	49.0	
Wamego†	90	28	54.5	0.00	Barren Crk Spgs†	85	26	56.3	
Washington†	93	27	55.0	0.39	Benedict†	83	31	58.7	
Winona†	82	28	58.4	T.	Boettcherville†	80	22	52.8	
Yates Center†	89			0.74	Cambridge†	88	36	61.9	
<b>Kentucky.</b>					Charlotte Hall†	77	29	56.6	
Bowling Green†	85	22	53.9	4.88	Cumberland†	80	25	54.0	
Burnside†				2.74	Cumberland†	81	31	56.7	
Caddo†	80	24	56.8	5.10	Darlington†	79	26	55.3	
Canton†	86	28	56.2	3.22	Easton†	82	31	58.4	
Carrollton†	87	27	56.3	3.48	Fallston†	80	30	54.9	
Cattlettsburg†	74	31	57.3	7.38	Fenby†	78	30	57.6	
Earlington†	87	28	59.3	3.65	Frederick†	81	28	54.9	
Eddyville†				5.34	Glyndon†	79	30	55.4	
Edmonton†	79	23	55.4	3.08	Great Falls†	77	28	55.2	
Eubank†	84	19	53.3	1.85	McDonogh†	78	32	56.8	
Falmouth†				5.67	Mt. St. Marys Col†	84	22	54.2	
Franklin†	85	30	58.6	4.36	New Market†	79	25	53.9	
Greensdale†	84	24	55.8	5.33	Oakland†	74	16	47.8	
Greensburg†	86	23	57.2	4.46	Solomons†	83	36	60.4	
Harrodsburg†	90	20	54.4	3.85	Sunnyside†	81	13	48.6	
Hendricks†				3.80	Taneytown†				
Louis†	81	25	53.4	6.10	Upper Marlboro†	82	26	56.0	
Madi†	84	34	58.0	1.50	Valley Lee†				
Middlesboro†	84	20	53.0	1.60	Woodstock†	81	24	54.1	
Mount Sterling†	82	25	53.1	4.29	<b>Massachusetts.</b>				
Munfordville†	83	23	57.8	2.65	Adams†	71	22	51.4	
Paducah†	87	30	60.2	5.25	Amherst†	77	23	51.6	
Pellville†	88	20	56.8	4.84	Amherst Ex. Stn†	79	22	51.7	
Princeton†	86	23	56.0	3.87	Amherst Ex. Stn†	80	23	52.6	
Russellville†	89	22	59.1	3.94	Andover†	88	25	54.0	
Shelby City†	82	27	56.9	2.28	Ashland†				
South Fork†				3.15	Bedford†	76	23	52.4	
Springfield†				3.54	Beverly Farms†	76	27	51.4	
Williamsburg†				2.90	Blue Hill (sum†)	76	25	52.3	
<b>Louisiana.</b>					Blue Hill (valley†)	72	22	52.2	
Abbeville†	93	40	68.4	1.09	Boston†				
Alexandria†	92	28	61.2	1.80	Cambridge†	80	27	54.5	
Amite†	89	34	64.2	1.14	Cambridge†	76	28	53.2	
Baton Rouge†	91	41	64.2	1.38	Chestnut Hill†	80	28	54.2	
Calhoun†	84	31	62.6	0.31	Clinton†				
Cheneyville†	98	30	65.6	1.45	Concord†	80	25	52.6	
Clinton†	92	32		1.59	Dudley†	76	26	52.4	
Coushatta†				0.87	East Templeton†	73	24	49.5	
Coushatta†				1.37	Egg Rock, Nahant†	73	31	52.2	
Covington†	88	32	63.1	3.24	Fall River†	73	29	53.9	
Davis†	86	30	59.2	1.50	Fiskdale†				
Delhi†				1.35	Fitchburg†	73	28	50.6	
Donaldsonville†	88	44	67.8	0.73	Fitchburg†	76	27	52.3	
Emile†	84	43	65.5	2.33	Framingham†	77	24	52.4	
Farmerville†	90	34	61.6	0.25	Gilbertville†	73	23	50.9	
Franklin†	87	42	67.2	0.48	Great Barrington†	74	22	50.4	
Girard†	92	31	60.0	1.16	Groton†	76	23	51.0	
Grand Coteau†	86	44	65.0	2.67	Groton†	79	23	54.1	
Hammond†	86	36	64.0	2.03	Hadley†	75	20	50.8	
Jeanette†	90	40	69.3	0.91	Hingham†				
Lafayette†	84	39	67.7	0.98	Hyannis†	74	30	55.7	
Lake Charles†	98	56	70.6	2.70	Kendall Green†				
Lake Providence†	87	34	62.2	0.48	Lake Cochituate†	80	22	52.4	

## Meteorological record of voluntary observers, &amp;c.—Continued.

Stations.	Temperature. (Fahrenheit.)			Precip'n.	Stations.	Temperature. (Fahrenheit.)			Precip'n.
	Max.	Min.	Mean			Max.	Min.	Mean	
<b>Massachusetts—Con.</b>					<b>Michigan—Cont'd.</b>				
Long Plain *4	73	28	50.0	4.10	Washington	82	22	49.4	5.15
Lowell a	76	27	53.0	3.83	Williamston *1	82	28	53.0	3.75
Lowell b	80	25	52.7		Ypsilanti	79	24	50.0	4.59
Lowell c	82	28	55.3		<b>Minnesota.</b>				
Ludlow Center	72	15	50.4	4.16	Ada†	72	10	44.8	1.10
Lynn b *1	81	26	56.4		Albert Lea †1	77	14	47.4	0.98
Mansfield *1	75	24	51.0	5.23	Alexandria a†				0.67
Medford				4.11	Alexandria b†	70	10	41.9	
Middleboro	74	22	51.9	3.26	Barrett *1	74	15	45.1	
Milton *1	73	25	51.5	2.29	Beardsley†	83	8	47.9	0.65
Monroe	70	19	47.0	4.51	Belle Plaine *1	80	22	47.4	1.40
Monson†	75	20	52.1	5.33	Bingham Lake †	80	9	47.3	0.91
Mystic Lake				4.05	Bird Island	76	9	45.7	0.89
Mystic Station				4.02	Blooming Prairie *1	80	12	47.8	3.05
New Bedford a†	70	27	51.9	2.45	Bonniwells Mills†	80	14	48.6	1.58
New Bedford b†	72	27	52.6	2.61	Caledonia†	82	15	50.0	1.96
Newburyport b				2.75	Cambridge†	79	8	46.4	1.76
North Billerica†	80	28	54.5	3.30	Camden†	89	10	46.0	0.69
Plymouth *1	73	32	54.9	2.16	Carver†				49.7
Provincetown.	69	26	53.9	1.59	Clear Lake†	78	11	45.0	1.57
Randolph				3.60	Clear Water *1	79	20	46.2	0.82
Roberts Dam				3.15	Collegeville.	79	11	48.8	0.49
Roxbury	76	29	53.9	3.39	Crookston a†	64	11	39.1	1.43
Royalston *1	72	28	51.0	4.75	Dassel *1	70	18	44.4	
Salem b				3.47	Farmington†	84	15	48.6	1.68
Salisbury				3.84	Fergus Falls†	71	13	43.5	
Somerset *1	76	26	55.1	2.70	Fort Ripley†				0.75
South Dennis.	71	26	53.0	1.99	Grand Meadow†	82	13	46.2	1.27
Springfield Army†	78	26	53.6	5.16	Granite Falls†	78	7	45.1	0.61
Taunton b	76	27	53.4	2.71	Hastings†	84	18	49.0	0.61
Taunton c	76	24	52.8	2.90	Hutchinson *1	78	16	45.9	0.80
Taunton d†	80	25	53.6	3.33	L. Winnibigoshish *1	71	14	41.4	1.09
Wakefield†	77	25	53.2	4.32	Leech Lake†	72	8	42.4	0.84
Waltham				4.13	Long Prairie†	72	4	42.4	0.41
Webster				5.01	Maple Plain.	80	15	47.8	2.71
Wellesley	78	22	52.8	3.39	Mazeppa *1				45.3
Westboro†	77	24	54.2	4.03	Medford†	83	15	47.7	1.93
Williamstown†	73	22	50.4	2.26	Milan†	82	2	45.3	0.15
Winchendon†				4.74	Minneapolis a†	79	14	48.3	1.42
Winchester				3.86	Minneapolis b†	82	14	47.6	
Winthrop	76	27	53.4	2.97	Minneapolis c†	82	17	48.0	
Worcester a	74	27	54.0	4.54	Minnesota City†	82	18	49.1	2.81
Worcester b	75	26	52.6	4.68	Montevideo†	80	7	47.2	0.40
<b>Michigan.</b>					Morris†	76	8	43.4	1.69
Adrian	85	30	51.8	4.49	New London	76	10	46.8	2.00
Albion†	79	26	51.5	3.86	New Richland *1 c	80	24	50.1	
Allegan	84	20	52.8	3.11	New Ulm	78	23	49.1	3.09
Ann Arbor†	77	26	49.9	5.29	Ortonville†				0.69
Arbela *2				3.69	Park Rapids†	66	10	42.2	2.10
Ball Mountain	77	22	49.8	4.82	Pine River *1	74	18	44.4	0.81
Bear Lake	73	23	48.0	4.82	Pokegama Falls†	70	6	41.8	0.69
Bellaire b	81	24	50.3		Redwood Falls†				1.07
Benton Harbor.	81	28	52.8	5.01	Rochester†	83	26	50.0	2.55
Berlin *1	82	21	49.8	4.93	Rolling Green†	78	15	47.6	1.50
Berrien Springs a *1	82	31	53.2	3.65	Royalton†	72	8	42.2	3.30
Berrien Springs b				2.86	Saint Charles†	80	13	48.2	3.30
Birmingham†	79	25	51.6	4.89	Saint Cloud *1	73	10	45.9	1.68
Boon	76	19	47.2	2.65	Saint Olo†	72	13	43.2	0.68
Bronson	89	23	52.8	3.35	Saint Peter†	85	17	50.4	1.36
Brown City b	79	23	48.8	3.80	Sandy Lake Dam†	75	10	42.7	T.
Calumet.	70	21	42.9	3.34	Sauk Center†	72	0	39.7	0.55
Charlevoix.	82	27	51.2	3.67	Wabasha *1	80	23	49.1	2.59
Cheboygan.	78	21	47.2	3.06	Waconia *1	78	14	47.2	2.00
Climax *11.	90	29	49.4	1.11	Wadena *1	73	20	45.6	0.33
Clinton	87	22	52.1	4.84	Warren†	64	9	31.0	0.53
Crystal Falls	72	16	44.0	2.70	Willmar†	75	10	44.0	1.02
Evart	83	19	46.1	2.14	Winona†	86	22	53.3	2.84
Fairview	80	23	49.6	3.48	<b>Mississippi.</b>				
Fitchburg	88	20	49.8	3.46	Aberdeen†	87	25	58.5	0.4
Flint	84	22	51.0	2.79	Agricultural College†	85	37	63.2	0.56
Gaylord.	77	21	48.2	4.11	Batesville†	86	31	58.8	0.28
Glenwood.	75	25	49.6	2.36	Biloxi†	85	51	68.4	8.00
Grand Rapids†	82	28	52.4	3.26	Briars	88	42	62.8	1.89
Grape	80	25	52.3	3.77	Brookhaven†	94	34	61.9	1.83
Hanover	78	25	52.2	3.34	Canton†	85	38	62.2	0.97
Harrison.	81	23	47.1	3.21	Clarkdale†	88	32	61.6	0.10
Harrisville	70	22	47.4	4.64	Columbus a†				0.82
Hart	72	25	50.0	3.05	Columbus b†	88	34	63.0	0.88
Hastings.	78	27	49.4	4.41	Corinth†	88	31	66.0	0.30
Hayes	80	24	52.1	2.76	Crystal Springs†	93	36	64.4	1.20
Howell	85	22	50.6	3.64	Duck Hill†	85	34	58.9	1.86
Jeddo	83	25	50.2	3.53	Edwards	88	38	63.0	2.11
Kalamazoo	80	29	52.4	3.08	Enterprise†	88	28	60.6	1.05
Lansing†	81	26	50.7	4.35	Fayette†	85	40	64.4	2.52
Lathrop *1	68	18	45.6	3.55	French Camp†	84	30	57.8	4.48
Lewiston	78	22	48.2	4.31	Greenville b†	90	34	63.1	0.34
Lodi	78	24	48.3	3.84	Hattiesburg†	88	35	66.8	1.01
Madison	85	23	51.4	4.46	Hazlehurst†	91	35	64.4	1.23
Manistee†	76	29	51.7	2.55	Hernando†	87	34	61.6	4.22
Marshall†	82	23	49.8	3.71	Holly Springs†	84	34	59.9	0.65
Mayville	83	23	51.7	3.29	Itta Bena *1	90	34	63.2	0.58
Mio	82	26	49.4		Jackson†	89	34	63.0	1.25
Mottville	84	22	51.8	2.40	Kosciusko†	86	34	60.4	0.00
North Marshall	79	23	49.6	2.76	Lake†	84	33	61.5	1.32
Oliver	79	18	50.8	2.70	Logtown†	87	43	65.9	5.54
Ovid	80	24	50.4	4.30	Louisville†	90	33	61.1	0.95
Paris.	80	20	45.8	3.27	McComb†	88	40	68.3	1.19
Parkville				3.05	Macon†	92	26	59.2	0.55
Rawsonville *1	82	26	51.6	4.67	Moss Point†	89	44	66.0	3.00
Rockland	83	18	46.8	2.98	Natchez†	90	38	64.9	2.46
Saint Ignace	68	22	46.7	2.84	Okolona†	87	29	59.7	0.57
Sand Beach	85	26	52.6	5.94	Palo Alto†	86	35	60.4	0.42
Stanton	82	23	49.6	2.97	Pontotoc†	88	33	61.7	0.95
Thornville†	82	29	51.3	3.24	Port Gibson†	93	31	62.6	2.13
Vandalia.	79	28	53.3	4.67	Stonington *1	88	42	62.9	

Meteorological record of voluntary observers, &amp;c.—Continued.

Stations.	Temperature. (Fahrenheit.)			Precip'n.	Stations.	Temperature. (Fahrenheit.)			Precip'n.
	Max.	Min.	Mean			Max.	Min.	Mean	
Mississippi—Cont'd.					Nebraska.				
Thorton*†	88	42	65.0	0.02	Agee*†	82	18	47.7	0.53
University†	87	30	57.0	0.60	Ansley†	82	10	47.8	0.00
Vaiden†	97	26	59.9	0.84	Ashland†	85	25	52.8	0.05
Water Valley*†	97	33	59.2	1.07	Ashton*†	88	24	47.7	0.43
Waynesboro*†	85	33	60.8	1.15	Hassett*†	86	15	47.3	0.06
Woodville†	88	34	65.6	0.91	Beatrice†	86	25	54.9	0.49
Yazoo City†	103	31	64.4	1.46	Beaver City†	87	22	51.6	0.45
Missouri.					Burwell*†	73	36	53.5	0.30
Appleton City†	89	30	57.7	0.08	Cullaway†	84	17	49.9	0.39
Arthur*†	86	26	51.8	0.20	Columbus†	87	18	50.5	0.18
Bethany†	86	27	54.6	0.33	Cornlea				
Big Piney†	88	26	56.4	1.11	Creighton†	86	17	45.5	0.42
Birch Tree†	88	26	56.4	1.06	Crete	90	22	54.0	0.13
Bluffton†	90	34	59.2	0.27	Culbertson†	84	21	45.0	0.25
Boonville†	87	33	58.6	0.60	Ericson*†	89	32	50.0	0.20
Brunswick†	88	30	59.4	0.15	Fairbury†	95	28	58.7	0.32
Carrollton†	87	28	57.5	1.22	Fort Robinson†	85	15	48.4	0.46
Conception†	87	28	57.5	0.60	Fort Sidney†	85	14	48.8	0.37
Cowdell*†	90	30	53.7	0.30	Franklin†	88	27	53.0	0.68
Darkeville†	90	28	58.7	0.92	Geneva†	94	22	54.3	0.31
East Lynne*†	89	29	53.8	0.20	Genoa†	88	20	50.6	0.49
Edge Hill*†	85	25	50.4	1.50	Gering†	84	21	49.6	0.52
Eight Mile*†	85	31	55.7	0.30	Glenwood*†	92	32	49.8	0.13
Eldon*†	90	34	58.6	0.60	Haigler*†	84	18	48.8	0.85
Emma*†	90	34	58.6	0.60	Hartington†	89	24	50.8	0.11
Fairport†					Hay Springs†	83	14	46.2	0.61
Farmersville†	95	29	59.6	1.73	Hebron†	93	18	53.6	0.17
Fayette†	84	32	57.4	0.87	Holdrege*†	77	28	53.9	0.50
Fox Creek*†	88	32	60.6	0.41	Imperial*†	80	25	51.4	0.41
Fulton†	88	32	60.6	0.41	Indianola*†	81	24	47.5	0.11
Gallatin*†	93	30	58.7	1.34	Kimball†	83	15	49.2	0.50
Gayoso†					Lexington†	86	18	52.8	0.01
Glasgow†	93	30	58.7	2.00	Lincoln†	90	24	54.4	0.01
Glensted†					Lynch*†	82	15	47.0	0.36
Gordonville*†	81	32.4	6.26	0.80	Madrid*†	84	17	48.6	0.55
Gorin*†	88	31	53.1	0.80	Marquette*†	90	30	50.0	0.22
Grove Dale†	90	23	55.8	0.56	Minden†	86	22	50.5	0.72
Half Way†	89	28	56.7	0.64	Mullen*†	74	20	47.5	0.00
Hastain†	89	28	56.7	0.64	Nesbit†	88	14	48.3	0.00
Hermann†	85	23	54.0	0.58	Norfolk†	85	16	49.1	0.49
Houston†	89	23	57.8	1.08	North Loup†	90	15	50.4	0.36
Humansville†	83	29	53.9	2.36	O'Neill*†	97	16	47.9	0.14
Ironton*†	89	32	57.0	0.80	Ough†	92	16	50.2	0.45
Jefferson City†	87	24	57.2	0.15	Palmer*†	92	16	50.2	0.45
Kidder†	87	31	57.8	0.07	Plattsmouth†	91	22	49.6	0.54
Lamar†	87	31	57.8	0.07	Red Cloud†	87	17	50.6	0.47
Lamonte†	92	30	55.5	2.62	Santee Agency†	75	25	53.2	0.20
La Plata*†	86	31	56.2	0.53	Seward*†	89	21	48.9	0.30
Lebanon†	90	26	59.8	0.00	State Farm†	91	23	54.2	0.13
Lexington†	92	30	59.2	0.17	Sutton†	92	21	50.0	0.10
Liberty†	85	28	51.7	0.23	Syracuse*†	87	25	54.2	0.44
Linn Creek†					Table Rock*†	82	26	58.0	0.17
Louisiana Bridge†					Wallace*†	80	20	47.7	0.00
McCune*†	90	28	55.9	0.38	Weeping Water*†	86	23	51.1	0.12
Marceline†					West Point*†	86	12	53.8	0.10
Marshall†	91	26	56.8	0.49	Whitman*†	80	10	41.8	0.28
Mexico†	91	27	56.4	0.44	York*†	88	24	58.1	0.10
Miami†	90	34	58.8	0.37	Nebraska.				
Mine La Motte†	83	29	55.9	1.49	Austin†	70	22	46.4	0.07
Mount Vernon†	88	31	59.4	1.31	Battle Mountain*†	76	31	54.1	0.05
New Boston†	88	26	53.3	0.54	Bellevue*†	86	21	49.8	0.04
New Hartford*†	88	26	53.8	0.35	Belmont†	70	25	46.3	0.04
New Haven*†	88	34	57.2	0.60	Beowawe*†	86	30	50.3	0.00
New Madrid†	87	34	59.6	4.49	Beowawe*†	88	30	55.0	0.15
New Palestine†					Carlisle†	73	16	41.8	0.00
Oakfield†	88	33	58.4	0.80	Carson City†	76	19	47.8	0.15
Oak Ridge*†	89	31	56.0	0.63	Crane Ranch†	92	28	57.0	0.00
Olden†	89	27	58.3	1.10	Downeyville†	68	21	43.8	0.01
Oregon*†	86	27	58.1	0.15	Edgewood†	70	20	45.9	0.00
Oregon*†	86	26	58.2	0.33	Elko*†	73	10	44.3	0.00
Oscola†					Elko (near)*†	73	25	51.0	0.20
Palmyra†					Genoa†	73	25	51.0	0.20
Panama†	88	24	55.0	0.79	Golconda*†	83	36	50.8	0.00
Phillipsburg*†	84	35	56.2	1.28	Gold Hill†	94	27	59.1	0.01
Platte River*†	84	28	50.6	0.77	Halleck*†	70	18	40.5	0.45
Potosi†	86	19	49.1	0.35	Hawthorne*†	77	42	56.3	0.01
Princeton*†	87	26	54.9	1.10	Hawthorne*†	79	27	51.8	0.01
Rolla†					Hot Springs*†	80	30	56.2	0.00
Road Springs†					Humboldt*†	64	26	45.2	0.00
Saint Charles†	88	28	57.4	0.37	Lowers Ranch†	76	26	48.7	0.34
Saint Joseph†	86	24	55.5	1.64	Lovelock*†	76	30	50.6	0.00
Saint Louis†	93	32	62.1	2.06	McDermitt†	74	16	43.3	0.00
Sarco*†	91	30	58.5	0.88	Mill City*†	81	25	57.3	0.00
Sedalia†					Monitors Ranch†	71	17	42.9	0.00
Shelbina†					Palisade*†	78	20	52.4	0.04
Steelville*†					Palmetto†	76	18	45.8	0.05
Steffenville†					Pioche†	68	32	51.0	0.45
Stellada†	91	29	59.4	1.15	Reno*†	67	33	47.7	0.00
Sublett*†	93	26	56.0	0.84	Reno State Univ'ty†	76	16	47.7	0.02
Tindall†					Saint Clair†	76	25	49.2	0.00
Unionville†	88	25	60.5	0.11	South Camp†	70	24	46.3	0.00
Vanclove†					Stoffel†	70	8	38.0	0.25
Vermont*†	90	30	55.8	1.27	Sunnyside†	80	15	57.0	0.00
Vilas†					Tecoma*†	66	24	42.3	0.00
Virgil City†					Toano*†	70	16	43.6	0.00
Warrensburg*†	89	32	58.7	0.75	Tuscarora†	70	12	43.1	0.25
Warrenton†	85	30	56.1	0.56	Tybo†	78	23	51.4	0.00
Wheatland†									
Whiteside†	88	28	56.4	0.40					
Montana.									
Fort Custer†	78	28	47.2	0.45					
Fort Keogh†	73	18	42.7	0.83					
Fort Missoula†	63	17	39.8	3.01					
Glendive†	75	24	45.0	0.95					

Meteorological record of voluntary observers, &amp;c.—Continued.

Stations.	Temperature. (Fahrenheit.)			Precip'n.	Stations.	Temperature. (Fahrenheit.)			Precip'n.
	Max.	Min.	Mean			Max.	Min.	Mean	
Nevada—Cont'd.					New Mexico—Cont'd				
Verdi**	75	35	48.5	1.60	Lordsburg**	87	40	59.1	0.00
Virginia City	73	32	52.0	0.10	Los Lunas†	73	26	49.0	T.
Wadsworth*	70	26	44.7	0.00	Monero†	69	15	41.8	0.22
Wells*	80	25	43.0	1.15	Olio†	78	26	52.2	0.00
Winnemucca**	74	25	48.3	0.16	Pojuaque				0.11
New Hampshire.					Socorro†	82	26	54.5	T.
Alstead*	68	18	47.8	2.70	Sulphur Hot Sp'gs	67	17	41.4	0.30
Antrim				3.60	Taos†	78	18	46.8	0.00
Belmont				5.59	New York.				
Berlin†	77	14	46.8		Addison†	77	23	49.5	2.89
Berlin Mills	79	14	46.8	3.80	Alfred Center	80	24	49.3	3.30
Bethlehem				4.08	Angelica†	79	16	47.2	2.49
Brookline*	76	25	50.1	4.70	Arcade†	77	24	47.8	3.77
Concord a	71	19	49.0	4.77	Arkwright	75	30	50.3	
Dublin	70	23	49.5	5.50	Atlanta				2.80
Durham	76	26	51.8	5.16	Baldwinsville†	75 <sup>a</sup>	26 <sup>a</sup>	51.2 <sup>a</sup>	1.95
East Canterbury	67	25	48.4	6.41	Bedford				6.07
Grafton†	78	16	48.0	4.57	Binghamton†	76	17	50.4	1.68
Hanover a†	70	20	49.1	3.00	Bolivar				2.58
Keene	73	18	49.8	3.54	Boonville				2.18
Lakeport				4.90	Bovine Center				4.04
Lancaster	78	13	48.9	3.30	Brookport	78 <sup>f</sup>	30 <sup>b</sup>	51.8 <sup>b</sup>	1.85
Littleton†	73	15	47.2	3.13	Brookfield†	73	12	46.7	0.75
Manchester†	78	25	52.4	3.31	Cherry Creek				5.75
Mine Falls				3.43	Cooperstown†	72	20	48.0	1.27
Nashua	78	23	51.9	3.35	Cortland	69	24	49.1	3.73
Newton	78	22	50.8	4.63	De Kalb Junction				1.30
North Conway	78	18	48.8	4.50	Demster				2.54
Pennicook Station				3.51	Dunkirk	73	31	51.3	2.80
Peterboro	76	16	48.9	3.95	Easton				2.45
Plymouth†	73	14	46.2	5.40	Eden Center	85	28	49.1	3.45
Sanborn†	74	19	48.8	5.07	Ellis				2.15
Stratford	80	14	51.8	3.37	Elmira*†	77	25	53.5	2.66
Wiers Bridge				5.20	Factoryville†	80	18	50.8	2.34
West Milan	80	11	47.5	3.26	Fleming†	79	28	52.3	0.98
Wolfboro				5.19	Fort Niagara†	80	33	54.1	2.62
New Jersey.					Friendship†	78	19	47.1	3.07
Allaire	79	23	53.4		Geneva†	78	26	51.3	1.63
Asbury Park.	79	30	55.8	3.36	Gloversville†	76	20	47.9	1.62
Barnegat	79	27	55.7	2.21	Hess Road Station†	72	29	50.4	2.69
Bayonne	80	28	56.6	3.90	Honeymead Brook†	73	21	51.1	3.73
Belvidere	81	31	55.0	2.24	Humphrey†	86	21	50.2	4.27
Beverly†	84	36	54.2	4.20	Ithaca†	76	21	50.6	2.15
Billingsville*	76	34	56.0	3.80	Jamestown**	76	26	51.6	
Blairstown				2.84	Kings Station				1.97
Boonton				4.78	Lebanon Springs	73	18	48.5	2.79
Bridgeton a	81	31	57.8	5.35	Le Roy	78	26	50.1	2.34
Camden	76	29	55.7	4.01	Lockport	83	26	52.0	2.68
Cape May C. H.	79	26	56.2	2.04	Lowville	78	20	49.0	1.69
Charlotteburg	77	17	51.2	5.37	Lyons†	75	28	51.8	1.91
Chester	73	26	52.2	5.18	Madison Barracks†	83	29	51.2	1.74
Deckertown	76	23	52.8	3.76	Malone†	74	23	49.2	1.30
Dover	78	19	53.6	4.85	Middletown†	78	30	52.5	3.10
Egg Harbor City†	80	25	53.6	3.30	Minnewaska†	70	26	49.2	4.90
Elizabeth†	80	27	55.8	4.85	Mount Morris	80 <sup>a</sup>	21 <sup>a</sup>	50.6 <sup>a</sup>	1.88
Franklin Furnace	76	26	51.8	3.22	Newark Valley				2.68
Franklinville	80	33	54.3	5.58	New Lisbon	76	16	48.6	1.25
Freehold†	78	24	55.2	4.89	Number Four†	74	21	47.3	2.35
Freeburg				4.50	Ogdensburg†	81	25	50.4	0.63
Gillette	76	20	53.0	4.41	Oxford	75	20	49.3	1.46
Hanover	76	24	54.2	3.89	Palermo†	75	25	50.7	2.24
Highland Park†	78	24	54.4	4.15	Perry City†	74	19	48.0	2.74
Hightstown†	79	29	55.6	6.17	Phoenix				1.62
Inlaystown.	78	26	55.6	4.67	Pine City				2.65
Junction				3.29	Plattsburg B'ks	70	22	49.0	0.85
Lambertville	79	26	55.6	2.77	Port Jervis	77	20	51.8	3.67
Locktown	78	35	54.3	4.01	Potsdam†	75 <sup>a</sup>	26	49.6	1.02
Millville	84	34	57.2	3.44	Poughkeepsie	80	19	52.3	2.75
Moorestown†	81	27	54.9	6.16	Rome	77	21	51.2	2.56
Newark a	78	20	54.8	5.99	Romulus	77	26	51.7	1.65
Newark b†	78	30	56.2	5.33	Setauket†	74	35	55.3	4.00
New Brunswick a	80	24	56.4	3.61	South Canisteo†	77	18	47.0	4.05
New Brunswick b.	78	25	54.6	4.32	South Kortright†	73	15	47.4	2.05
Newton	79	22	53.1	2.82	Stillwater†	72	23	50.6	1.97
Ocean City	76	29	57.7	2.46	Turin	73 <sup>f</sup>	25 <sup>f</sup>	47.5 <sup>f</sup>	1.97
Oceanic	78	37	57.8	4.20	Wappingers Falls.	78	22	52.9	3.53
Paterson	81	26	56.6	5.86	Warwick				2.87
Pensauken				4.28	Westwood†	80	18	48.4	2.57
Perth Amboy	78	27	55.4	5.26	West Chazy				1.57
Plainfield	76	23	54.6	5.02	West Point†	79 <sup>a</sup>	32	58.3 <sup>a</sup>	4.25
Rancocas				5.06	Willels Point.	78	34	55.3	4.35
New Mexico.					North Carolina.				
Readington**	80	30	60.3		Asheville†	81	23	55.8	5.36
River Vale†	78	19	53.0	4.43	Auburn				3.92
Salem	73	20	54.2	3.04	Bailey**	85	30	59.0	0.89
Somerville	84	23	56.7	4.68	Bakersville†	84	18	53.5	5.52
South Orange†	76	27	53.6	5.30	Blowing Rock†	76 <sup>1</sup>	19 <sup>1</sup>	54.9 <sup>1</sup>	5.64 <sup>1</sup>
Tenafly†	77	20	54.3	6.59	Bryson City†				1.00
Toms River	81	30	53.5	4.48	Chapel Hill†	88	29	59.2	6.75
Trenton	78	25	56.9	4.40	Columbia	78	26	54.7	11.31
Vineland	85	25	57.4	3.72	Curruck Inlet†				2.53
Whiting	83	26	56.0	3.98	Douglas	80	23	53.4	7.10
Woodbine	79	24	55.5	3.14	Experiment† Farm	77	31 <sup>c</sup>	60.4 <sup>c</sup>	5.27
New Mexico.					Falkland†	83	36	62.3	4.34
Alberty†	87	35	58.2	0.16	Fayetteville†				4.73
Albuquerque†	80	30	52.3	0.09	Flat Rock	78	20	53.4	8.56
Chama†	80	19	47.4	0.25	Goldsboro†	83	35	62.3	4.46
Coalfield†	71	20	45.9	0.00	Greensboro†	82	26	63.1	8.78
Deming*	89	53	70.3	0.00	Greenville				5.77
East Las Vegas†	85	18	48.6	0.04	Henderson†	87	29	58.5	6.39
Fort Bayard	81	30	55.6	0.00	Highlands†	74	30	50.5	2.30
Fort Wingate	92	24	52.7	0.00	Horse Cove†	77	25	55.0	1.56
Galinas Spring†	78	31	55.9	0.00	Lenoir**	79	28	56.6	8.30
Halls Peak†	78	14	47.2	T.	Lewiston				6.66
La Luz†	77	39	59.0	0.04	Lillington†				5.38
Las Cruces†	87	27	56.7	0.03					



Meteorological record of voluntary observers, &amp;c.—Continued.

Stations.	Temperature. (Fahrenheit.)				Precip'n.	Stations.	Temperature. (Fahrenheit.)				Precip'n.
	Max.	Min.	Mean.				Max.	Min.	Mean.		
N. Carolina—Cont'd.						Ohio—Cont'd.					
Littleton t.	87	28	57.6	6.00		Granville t.	87	20	52.7	3.75	
Louisburg t.	79	39	58.4	4.21		Gratiot t.	87	22	54.5	4.97	
Lumberton t.	92	34	63.4	6.71		Greenfield t.	78	35	53.0	3.80	
Lynn t.	84	36	56.2	7.77		Green Hill t.	87	21	52.4	5.51	
Marion t.	89	23	57.6	8.75		Greenville t.	79	22	51.8	2.61	
May t.	81	32	61.2	5.32		Guyville t.	88	20	53.0	5.63	
Mocksville t.	82	28	59.3	6.54		Hackney t.	87	25	55.4	5.85	
Morganton t.	87	27	57.5	10.70		Hanging Rock t.	86	25	53.2	6.66	
Mount Airy t.	81	22	56.4	5.96		Harbor t.	85	30	53.0	6.09	
Mount Pleasant t.	85	28	58.8	6.53		Hillhouse t.	87	26	53.6	7.10	
Murphy t.						Hillsboro t.	89	20	54.7	3.71	
Newbern t.	76	37	60.4	4.47		Hiram t.	84	23	51.1	5.19	
Oak Ridge t.	82	25	56.6	7.26		Jacksonboro t.	87	27	53.8	2.25	
Pittsboro t.	81	27	58.0	5.70		Kenton t.	90	20	53.8	4.09	
Raleigh t.	88	31	61.0	5.20		Kilbourne t.	82	23	53.5	3.28	
Rockingham t.	82	30	59.6	3.83		Killbuck t.	87	26	53.1	3.82	
Roxboro t.	81	27	57.0	7.28		Leipsic t.	90	22	53.5	3.70	
Rutherford Co. t.	69	26	52.4	9.26		Levering t.	84	18	50.8	3.42	
Salisbury t.	80	30	60.0	5.89		Logan t.	90	20	53.0	5.81	
Saxton t.	84	22	56.1	6.83		Lordstown t.	90	21	51.0	5.26	
Shelby t.	81	27	58.2	8.75		Lakeview t.	90	21	54.9	4.52	
Sloan t.	82	34	62.5	4.81		McConnellsville t.	87	21	56.2	5.65	
Smithfield t.	83	33	60.2	5.17		Mansfield t.					
Soapstone M. t.	85	25	58.2	6.89		Marietta t.	82	28	55.1	5.14	
Southern Pines t.	83	30	61.0	5.81		Marietta b. t.	88	20	52.1	4.44	
Tarboro t.	88	33	61.1	4.84		Marion t.	87	21	52.9	2.84	
Weldon t.	84	31	59.6	5.46		Millford t.	88	19	53.3	5.44	
Wilkesboro t.	85	33	60.0	3.28		Millport t.	84	18	52.2	5.64	
North Dakota.						Montpelier t.	89	22	50.7	3.07	
Ashley t.	72	8	40.2	0.99		Mountville t.	88	21	55.6	6.00	
Berlin t.	72	9	40.0	0.72		Napoleon t.	84	24	53.6	3.71	
Bottineau t.	64	6	37.2	1.19		Nelsonville t.					
Churchs Ferry t.	68	8	38.6	0.94		New Alexandria t.	82	25	55.1	4.71	
Dickinson t.	68	11	41.2	0.37		New Berlin t.	82	22	51.7	6.10	
Ellendale t.	72	10	39.8	0.86		New Comerstown t.	88	20	53.5	3.73	
Fargo t.	72	11	41.1	0.90		New Holland t.	80	20	52.3	2.60	
Forman t.	75	7	43.8	0.76		New Paris t.	88	23	53.9	4.85	
Fort Berthold t.	66	8	39.5	1.49		North Lewisburg t.	88	23	52.9	4.47	
Fort Stevenson t.	70	8	41.0	0.69		North Royalton t.	85	23	52.4	4.63	
Fort Yates t.	74	13	43.2	0.51		Northwood t.	95	20	54.8	4.63	
Gallatin t.	70	8	39.3	1.07		Oberlin t.	87	26	52.4	4.25	
Grand Forks t.	67	10	38.4	1.27		O. S. University t.	85	23	53.7	3.30	
Jamestown t.	67	13	42.7	0.94		Pataskala t.	88	21	53.5	3.50	
Joslyn t.	70	3	38.4	1.02		Plattsburg t.	84	24	53.1	3.45	
Kelso t.	76	12	41.7	1.45		Pomeroy t.	82	24	55.0	5.77	
Larimore t.	68	9	40.0	0.52		Portsmouth t.	86	28	53.4	5.98	
Milton t.	63	7	35.6	1.70		Ridge t.	82	22	54.2	5.92	
Minto t.	65	10	39.6	1.06		Ridgeville Corners t.	86	17	52.5	2.58	
Napoleon t.	72	8	41.2	1.38		Ripley t.	82	20	55.4	3.84	
New Salem t.	75	12	42.8	1.21		Rittman t.	81	15	52.7	5.98	
Oakdale t.	65	10	41.9	1.32		Rush Creek t.					
Power t.	78	11	41.3	1.64		Sharon Center t.	82	32	58.0	4.52	
Saint John t.	60	13	36.0	0.83		Shenandoah t.	86	20	54.8	3.34	
Shenandoah t.	72	10	40.8			Sidney t.					
Wahpeton t.	78	13	45.2	0.89		Springboro t.					
Washburn t.	79	0	45.8	1.28		Stoutsville t.					
Wild Rice t.			38.8	1.18		Sylvania t.	85	19	51.5	4.83	
Williamsport t.	70	6	42.2	0.81		Thurman t.	86	26	55.9	5.98	
Willow City t.	68	4	39.1	1.05		Union t.	85	26	53.1	5.72	
Woodbridge t.	62	6	37.2	1.67		Upper Sandusky t.	82	24	55.5	5.31	
Ohio.						Vanceburg t.	95	30	62.8	4.57	
Akron t.	82	27	53.4	4.92		Van Wert t.	84	19	52.7	3.21	
Annapolis t.	87	22	53.2	5.50		Vermillion t.	84	25	52.4	3.97	
Athens t.	86	23	54.3	6.49		Vickery t.	82	21	52.3	4.29	
Auburn t.	86	23	49.8	3.40		Walnut t.					
Bangorville t.	83	21	53.4	4.37		Warren t.	88	24	52.8	5.00	
Batavia t.				2.98		Wauseon t.	85	18	51.2	3.31	
Bement t.	86	23	48.8	4.50		Waverly t.	88	30	53.7	3.91	
Benton Ridge t.	87	18	53.9	3.35		Waynesville t.					
Bethany t.	82	25	52.0	3.18		Wellington t.					
Big Prairie t.	83	24	53.2	4.45		Westerville t.	80	26	50.6	3.56	
Bisnola t.	83	25	54.6	4.32		Weymouth t.	89	23	53.5	4.12	
Bisnells t.	85	25	53.6	4.95		Wheeler t.					
Bladensburg t.	87	19	52.4	3.29		Wilmington t.	86	25	55.2	3.73	
Bloomington t.	86	25	52.2	3.73		Wooster t.	85	24	52.0	5.15	
Bloomington t.				4.20		Wooster b. t.					
Bowling Green t.	88	22	50.8	3.18		Youngstown t.	82	20	50.5	3.95	
Bucyrus t.	84	20	51.8	4.15		Zanesville t.					
Cadiz t.				5.50		Oklahoma Ter.					
Caledonia t.				4.31		Anadarko t.	96	28	63.0	0.00	
Cambridge t.	84	21	52.7	6.58		Britton t.					
Camp Dennison t.	82	25	51.1	2.75		Buffalo t.	90	36	62.1	0.68	
Canal Dover t.	85	28	49.2	3.97		Burnett t.	89	24	61.6	0.90	
Canton t.	83	27	52.6	5.25		Cloud Chief t.	91	26	57.2	0.00	
Cardington t.	84	20	50.8	2.87		Fort Reno t.	91	31	61.5	0.00	
Carrollton t.	88	23	54.0	4.99		Fort Sill t.	92	30	61.2	0.00	
Cedarville t.				4.19		Fort Supply t.	92	30	57.0	0.00	
Celina t.	83	29	55.6	2.09		Guthrie t.	99	35	65.3	0.00	
Cherry Fork t.	85	19	52.6	2.42		Keokuk Falls t.	86	25	59.8	0.23	
Chicago t.				3.68		Mangum t.	91	31	61.9	0.08	
Circleville t.				4.25		Ponca t.	98	30	61.7	0.00	
Clarksville t.	86	27	53.4	4.71		Winnview t.	90	34	64.7	1.00	
Cleveland t.	85	28	52.5	6.43		Oregon.					
Coalton t.	88	18	55.9	5.29		Albany t.	68	31	47.5	6.82	
Colebrook t.				5.99		Albany b. t.	66	34	50.3	4.93	
Dayton t.	84	23	54.3	3.81		Arlington t.	68	32	50.1	2.27	
Dayton b. t.				4.65		Ashland t.	67	32	48.0	2.05	
Demos t.	85	27	55.7	4.84		Ashland b. t.	70	28	49.8	2.51	
Dupont t.	83	20	54.2	3.15		Aurora t.	70	35	53.1	9.09	
Ellsworth t.	81	24	52.5	4.16		Aurora (near) t.	65	29	49.6	8.77	
Elyria t.	87	25	52.9	4.24		Bandon t.	62	37	50.7	11.33	
Findlay t.	85	17	52.2	3.41		Brownsville t.	67	32	49.8	6.44	
Forestburg t.	85	23	54.3	4.19		Burns t.	70	20	43.2	1.04	
Frankfort t.	85	29	53.6	3.97		Canyon City t.	78	25	49.2	2.62	
Garrettsville t.	87	18	50.2	5.03							

Meteorological record of voluntary observers, &amp;c.—Continued.

Stations.	Temperature. (Fahrenheit.)			Precip'n.	Stations.	Temperature. (Fahrenheit.)			Precip'n.
	Max.	Min.	Mean.			Max.	Min.	Mean.	
<i>Oregon—Cont'd.</i>	°	°	°	<i>Ins.</i>	<i>Pennsylvania—Con.</i>	°	°	°	<i>Ins.</i>
Cascade Locks .....	65	28	49.2	8.00	Pottstown .....	81	27	55.5	3.13
Comstock .....	65	38	49.0	7.90	Quakertown .....	74	23	52.3	3.42
Corvallis a .....	66	38	48.6	5.67	Reading ? .....			52.6	3.18
Corvallis b .....	62	24	46.3	5.12	Ridgway .....				2.30
Corvallis (near) .....	67	31	49.2	6.18	Saegertown .....	88	20	50.8	3.00
East Portland .....	65	30		3.20	Salem Corners .....	76	19	48.7	2.70
Eugene .....				6.64	Saltsburg ? .....				2.79
Forest Grove .....	60	23	45.6	7.24	Seisholtzville .....				3.19
Gardiner .....	68	40	51.9	9.68	Selins Grove .....	75	26	52.4	4.21
Glenora .....	71	26	47.6	10.57	Skippack ? .....	88	25	54.5	2.50
Grants Pass a ? .....	75	29	50.6	2.05	Smithport .....	81	17	50.5	3.65
Grants Pass b .....	70	37	51.0	2.17	Smiths Corners .....				4.32
Heppner ? .....	68	30	47.0	2.15	Somerset ? .....	81	18	49.2	3.02
Hood River (near) .....	68	30	46.0	9.81	South Easton .....	79	21	52.0	1.88
Hubbard .....	65	30	48.3	9.92	State College ? .....	70	21	51.8	3.23
Jacksonville .....	70	29	49.3	2.40	Stoyestown ? .....				4.61
Joseph ? .....	64	24	40.4	4.89	Swarthmore .....	80	27	56.5	3.35
Junction City .....	70	38	52.0	4.60	Uniontown ? .....	81	29	56.2	3.22
Lafayette .....	68	32	52.0	6.78	Warren ? .....				3.53
La Grande ? .....	71	27	46.0	5.13	Wellsboro * ? .....	74	20	46.0	2.88
Lakeview ? .....	70	22	41.9	1.59	West Chester .....	80	28	55.3	3.45
Langlois .....	73	38	55.4	9.62	West Newton ? .....				2.54
Leland .....	72	34	48.5	3.11	Westtown .....	80°	28°	54.0°	
Lone Rock .....	65	12	41.1	2.07	Wilkesbarre ? .....	82	21	53.3	1.70
McMinnville a ? .....	68	36	48.9	4.15	Wyox ? .....	80	22	50.7	1.33
McMinnville b .....	68	30	48.9	4.15	York ? .....	82	22	54.2	3.03
Monmouth .....	67	34	51.9	5.52	<i>Rhode Island.</i>				
Mount Angel ? .....	67	30	47.6	7.59	Kingston ? .....	72	27	51.6	3.02
Newport .....	75	33	52.2	6.47	Lonsdale .....				3.90
Oregon City .....	65	36	52.7	8.64	Newport .....	70	34	55.9	
Pendleton .....	69	28	48.1	2.35	Olneyville .....	78	39	59.0	
Portland .....	67	32	50.6	5.92	Pawtucket .....	76	25	53.8	3.47
Riddles .....	66	36	48.7	3.23	Providence a .....	75	30	54.5	4.25
Roseburg .....	67	41	51.3	6.34	Providence c .....	77	27	53.5	4.49
Salem a .....	64	30	48.7	6.34	<i>South Carolina.</i>				
Salem b ? .....	64	29	48.4	7.49	Allendale .....	86	33	66.0	3.14
Sheridan .....	70	33	51.0	5.86	Anderson ? .....				5.36
Silverton .....	68	30	48.7	7.70	Batesburg .....	84	30	62.8	3.94
Siskiyou .....	65	32	48.8	1.95	Blackburg .....				6.09
Sparta .....	68	26	44.2	3.33	Blackville ? .....	86	35	66.1	3.87
Springbrook .....	69	30	49.5	6.19	Blenheim .....	83	35	60.2	
Springfield .....	64	33	48.8	7.44	Brewer Mine ? .....	83	31	60.0	7.25
The Dalles ? .....	64	30	49.3	3.40	Camden ? .....				4.13
Toledo .....	70	31	51.2	8.30	Central ? .....			58.8	3.96
Umatilla ? .....				1.53	Cheraw ? .....	84	32	62.0	2.79
Vale .....	70	21	46.4	0.64	Cheraw b ? .....				3.39
Vernonia .....	65	30	47.8	7.34	Clemson College ? .....				3.72
West Fork .....	72	32	51.9	3.95	Connors .....	83°	34	64.6°	6.59
Weston .....	63	22	46.4	4.12	Cross Hill ? .....	80	35	62.2	5.49
Williams .....	70	27	49.0	2.73	Darlington .....	81	34	64.8	
<i>Pennsylvania.</i>					Effingham ? .....				4.93
Altouna .....	75°	33°	55.6°	2.71	Flint Hill ? .....	85	34	61.9	3.82
Aqueduct .....	83	22	53.3	3.29	Florence ? .....	84	38	63.8	4.41
Beaver Dam ? .....				5.63	Georgetown ? .....	82	39	66.0	4.33
Blooming Grove .....	76	20	49.4	1.51	Greenville ? .....	86	25	61.0	5.13
Bloomsburg .....	79	24	53.3	1.18	Greenwood ? .....	86	34	63.7	6.72
Blue Knob .....	70	18	49.2	6.58	Hardeeville ? .....	81	40	67.0	8.16
Brookville ? .....				2.49	Hollands Store ? .....	83	28	61.1	3.16
Browsers Lock .....				3.42	Kingstree ? .....	90	44	69.8	3.97
Carlisle .....	85°	31°	53.6°	0.97	Little Mountain .....	84	33	64.1	3.74
Chambersburg ? .....	80	28	54.4	3.85	Longshore ? .....	86	31	62.7	5.09
Clarion ? .....				3.40	Martins .....				4.95
Coteseville ? .....	91	22	53.3	4.06	Mount Carmel ? .....				3.25
Confluence ? .....				3.59	Nichols ? .....				7.04
Coopersburg ? .....	75	25	53.2	3.26	Pinopolis .....	77°	39	64.2°	7.07
Davis Island Dam ? .....				3.18	Port Royal ? .....	84	40	68.6	4.72
Doylstown .....				2.94	Saint Georges ? .....	88	36	65.0	4.93
Drifton .....	76	22	51.8	3.36	Saint Matthews ? .....	89	34	65.8	3.55
Du Bois ? .....				2.33	Saint Stephens ? .....				5.00
Dyersburg ? .....	79	15	48.1	2.17	Santuck ? .....	83	32	61.5	5.86
East Machunk .....	80	20	52.8	2.94	Simpsonville ? .....	86	30	60.8	5.98
Easton .....	75	24	53.0	2.62	Society Hill ? .....	82	32	61.2	4.52
Edinboro .....	70	24	50.4		Spartanburg ? .....	86	33	62.1	4.17
Emporium .....	79	24	53.0	3.36	Statesburg ? .....	81	33	62.3	4.68
Ficks of Neshami ? .....				3.35	Tillers Ferry ? .....				4.84
Frederick .....				2.45	Timmonsville * ? .....	85	45	66.9	
Freeport ? .....				3.99	Trenton ? .....	82	39	67.7	5.29
Girardville ? .....	78	28	52.1	3.67	Tril ? .....	90	32	67.8	5.49
Grampian .....	76	18	49.5	2.52	Waterlee ? .....				6.06
Greensboro ? .....				2.84	Watts .....	85	32	63.4	4.45
Hamburg .....	80	23	54.8	3.57	Yorkville .....	85	32	63.2	6.54
Hollidaysburg ? .....	80	17	51.3	3.93	Yongs Island ? .....	86	40	67.3	5.92
Honesdale ? .....	73	19	50.3	1.99	<i>South Dakota.</i>				
Huntingdon ? .....	82	21	52.5	3.30	Aberdeen ? .....	77	19	45.0	0.64
Johnstown ? .....	85°	24	54.9°	3.22	Alexandria ? .....	85	13	47.2	0.35
Kennett Square .....	84	22	55.8	2.37	Ashcroft ? .....	83	14	43.6	0.70
Kilmer .....	75	28	50.4	4.41	Beaer Valley .....	74	24	41.8	2.01
Lancaster .....	82	24	54.3	3.30	Bowdle ? .....	73	13	42.6	1.12
Lansdale .....				3.71	Brookings ? .....	81	6	44.3	0.44
Lebanon ? .....	80	22	53.3	3.95	Cross ? .....	78	14	43.2	0.85
Le Roy ? .....	77	24	52.0	3.91	De Smet ? .....	84	7	46.7	T.
Lewistown .....	82	22	52.6	3.30	Fanklton ? .....	79	15	44.4	1.61
Ligonier .....	87	18	51.5	2.08	Flandreau ? .....	72	6	45.0	0.42
Lock Haven ? .....	83	22	52.4	2.67	Forestburg ? .....	78	13	46.6	0.05
Lock No. 4 ? .....				3.84	Forest City ? .....	79	20	48.2	4.70
Lycippus .....	78	36	55.6	2.92	Fort Meade .....	82	21	47.6	3.48
Mahoning ? .....				3.40	Fort Snily .....	84	30	49.0	3.00
Newcastle ? .....	82	19	52.3	4.59	Frankfort ? .....	80	7	41.0	0.53
Oil City ? .....				4.02	Gary ? .....	78	9	45.2	0.48
Ottaville .....				3.08	Greenwood ? .....	85	13	48.6	0.16
Parker ? .....				4.38	Hitchcock .....				0.58
Philadelphia a .....				2.71	Hotch City ? .....	82	14	45.2	0.85
Philadelphia b .....	80	30	57.4	3.56	Howard ? .....	79	9	45.8	0.22
Phoenixville .....	83	25	55.7	3.49	Kimbali ? .....	80	14	47.4	0.31
Point Pleasant .....				4.08	Mellette .....	78	12	45.2	0.54

*Meteorological record of voluntary observers, &c.—Continued.*

Stations.					Temperature. (Fahrenheit.)					Stations.					Temperature. (Fahrenheit.)					Stations.					Temperature. (Fahrenheit.)				
					Max.	Min.	Mean	Precip'n.							Max.	Min.	Mean	Precip'n.							Max.	Min.	Mean	Precip'n.	
<i>S. Dakota—Cont'd.</i>										<i>Texas—Cont'd.</i>										<i>Virginia—Cont'd.</i>									
Northville <sup>1</sup> .....	73	0	0	Ins.						McGregor <sup>1</sup> .....	82	0	0	Ins.						Wytheville <sup>1</sup> .....	78	21	52.0	6.74					
Oelrichs <sup>1</sup> .....	80	16	42.5	0.91						Marshall <sup>1</sup> .....	95	38	56.3	0.00						Washington.....									
Parker <sup>1</sup> .....	80	15	46.4	0.25						Merndville <sup>1</sup> .....	95	40	67.5	0.55						Aberdeen <sup>1</sup> .....	69	29	48.8	8.37					
Parkston <sup>1</sup> .....	81	12	46.4	0.19						Mesaquite <sup>1</sup> .....	94	34	66.2	0.47						Anacortes.....				2.58					
Rosbud <sup>1</sup> .....	83	15	45.5	0.34						Mountain Spring <sup>1</sup> .....	96	32	65.7	0.92						Blaine <sup>1</sup> .....	63	22	46.6	3.36					
Spearsburg <sup>1</sup> .....	80	23	46.1	3.50						New Brannfels <sup>1</sup> .....	95	39	68.8	0.00						Bridgeport <sup>1</sup> .....	82	18	50.2	0.19					
Tyndall <sup>1</sup> .....	85	18	49.4	0.30						Orange <sup>1</sup> .....	90	40	66.0	1.02						Centerville <sup>1</sup> .....	71	26	46.1	3.93					
Webster <sup>1</sup> .....	83	8	46.1	1.13						Paris <sup>1</sup> .....	91	37	65.3	0.39						Chelan <sup>1</sup> .....	66	25	46.9	0.24					
Wentworth <sup>1</sup> .....	77	8	41.0	0.21						Rio Grande City <sup>1</sup> .....	92	34	65.3	0.27						Colfax <sup>1</sup> .....	62	26	44.8	5.27					
Wessington Spgs <sup>1</sup> .....	86	14	48.0	0.31						Ruby <sup>1</sup> .....	94	34	65.3	0.17						Connell <sup>1</sup> .....	72	19	49.9	1.15					
Whitewood <sup>1</sup> .....				3.15						Rockport <sup>1</sup> .....	92	32	72.3	0.00						Crystal Springs <sup>1</sup> .....	65	15	50.4	.....					
Wolsey <sup>1</sup> .....	75	11	42.9	0.34						San Marcos <sup>1</sup> .....				0.00						Dayton <sup>1</sup> .....	83	13	44.5	1.60					
<i>Tennessee.</i>										Sherman <sup>1</sup> .....	90	38	66.2	0.05						East Sound <sup>1</sup> .....	72	28	49.2	4.96					
Andersonville <sup>1</sup> .....	87	24	55.4	0.98						Sierra Blanca <sup>1</sup> .....	84	38	61.2	0.00						Elbe <sup>1</sup> .....	62	32	48.2	2.99					
Arlington <sup>1</sup> .....	80	36	57.8	1.73						Silver Falls <sup>1</sup> .....	91	31	63.0	0.05						Ellensburg <sup>1</sup> .....	68	17	44.2	0.71					
Ashwood <sup>1</sup> .....	82	39	56.6	2.01						Stella <sup>1</sup> .....	91	42	68.8	1.25						Ferry <sup>1</sup> .....	60	28	47.6	8.97					
Bethel Springs <sup>1</sup> .....	84	43	62.1	2.01						Sulphur Springs <sup>1</sup> .....	101	32	64.5	1.13						Fort Simcoe <sup>1</sup> .....	65	27	47.6	1.33					
Bolivar <sup>1</sup> .....	84	30	55.6	0.54						Temple <sup>1</sup> .....	92	42	67.0	0.00						Fort Spokane <sup>1</sup> .....	66	17	45.2	0.81					
Brownsville <sup>1</sup> .....	86	30	60.0	1.43						Tyler <sup>1</sup> .....	90	40	67.0	1.03						Fort Townsend <sup>1</sup> .....	64	27	46.4	1.87					
Byrdstown <sup>1</sup> .....	82	28	58.2	2.38						Victoria <sup>1</sup> .....	92	60	73.5	0.00						Madrone <sup>1</sup> .....	64	28	48.4	4.11					
Carthage <sup>1</sup> .....				2.51						Waco <sup>1</sup> .....	94	38	67.7	0.00						Moxee Valley <sup>1</sup> .....	72	13	46.2	0.55					
Charleston <sup>1</sup> .....				1.12						Weathersford <sup>1</sup> .....	94	40	66.4	0.17						Olga <sup>1</sup> .....	60	32	48.6	2.60					
Clarksville <sup>1</sup> .....	83	27	59.2	3.79						Wichita Falls <sup>1</sup> .....	99	38	74.2	T.						Pine Hill <sup>1</sup> .....	65	32	46.5	7.03					
Clinton <sup>1</sup> .....				1.85						<i>Utah.</i>										Pomeroy <sup>1</sup> .....	67	31	48.1	3.73					
Columbia <sup>1</sup> .....				2.27						Blue Creek <sup>1</sup> .....	73	39	48.1	0.30						Pullman <sup>1</sup> .....	64	26	42.4	4.64					
Covington <sup>1</sup> .....	92	32	59.2	3.72						Castle Gate <sup>1</sup> .....	73	26	47.4	0.06						Rosalia <sup>1</sup> .....	64	24	42.0	3.12					
Covington <sup>1</sup> .....	80	34	60.2	1.88						Clasco <sup>1</sup> .....	79	25	51.6	T.						Silver Creek <sup>1</sup> .....	64	29	47.0	8.23					
Dyersburg <sup>1</sup> .....	84	30	57.8	2.71						Corinne <sup>1</sup> .....	90	30	54.1	0.30						Tacoma <sup>1</sup> .....	68	25	47.6	5.63					
Florence Station <sup>1</sup> .....	83	30	57.4	2.71						Deseret <sup>1</sup> .....	77	18	48.7	0.25						Union City <sup>1</sup> .....	65	27	47.0	8.25					
Franklin <sup>1</sup> .....	84	24	56.2	2.62						Fillmore <sup>1</sup> .....	92	21	48.4	0.46						Vashon <sup>1</sup> .....	64	22	42.6	3.52					
Greenville <sup>1</sup> .....	78	27	55.3	3.49						Fort Du Chene <sup>1</sup> .....	77	19	48.2	0.16						Waterville <sup>1</sup> .....	61	12	42.4	0.48					
Harriman <sup>1</sup> .....	82	22	56.1	0.76						Green River <sup>1</sup> .....	77	22	49.0	0.00						West Ferndale.....	64	20	45.6	3.36					
Hohenwald <sup>1</sup> .....	86 <sup>a</sup>	24	59.5	2.68						Grouse Creek <sup>1</sup> .....	73	16	39.5	0.25						<i>West Virginia.</i>									
Jackboro <sup>1</sup> .....	82	22	53.8	0.86						Heber <sup>1</sup> .....	74	20 <sup>a</sup>	44.3	0.73						Beverly <sup>1</sup> .....	80	18	54.0	4.06					
Jackson <sup>1</sup> .....	84	31	56.5	1.50						Kelton <sup>1</sup> .....	73	25	47.6	0.00						Bluefield <sup>1</sup> .....	82	21	53.2	7.22					
Johnson City <sup>1</sup> .....	85 <sup>a</sup>	23 <sup>a</sup>	54.4	5.85						Koosharem <sup>1</sup> .....	70	15	42.6	T.						Buckhannon <sup>1</sup> .....	86	22	50.8	3.85					
Johnsonville <sup>1</sup> .....				3.90						Lake Park <sup>1</sup> .....	77	28	49.4	1.43						Buckhannon <sup>1</sup> .....	86	22	50.8	3.85					
Kingston <sup>1</sup> .....				0.99						Levan <sup>1</sup> .....	77	28	49.4	1.43						Central Station <sup>1</sup> .....	84 <sup>a</sup>	18 <sup>a</sup>	56.0 <sup>a</sup>	4.66					
Loudon <sup>1</sup> .....				1.67						Loa <sup>1</sup> .....	74	14	42.3	0.00						Charleston <sup>1</sup> .....	83	18	49.8	5.67					
Lynnville <sup>1</sup> .....	83	28	57.0	1.54						Lones <sup>1</sup> .....	73	20	43.8	T.						Davis <sup>1</sup> .....	83	18	49.8	5.76					
Milan <sup>1</sup> .....	84	28	58.4	3.06						Moab <sup>1</sup> .....	76	27	51.2	0.05						Elkhorn <sup>1</sup> .....	83	25	55.5	5.60					
Missionary Ridge <sup>1</sup> .....	83	32	57.5							Mount Carmel <sup>1</sup> .....	77	20	46.6	0.00						Ella <sup>1</sup> .....	80	30	54.4	4.62					
Newport <sup>1</sup> .....	83	24	53.2	3.67						Ogden <sup>1</sup> .....	77	35	55.6	0.95						Flairmont <sup>1</sup> .....	82	23	54.4	5.23					
Nunnely <sup>1</sup> .....	81	26	56.9	0.72						Ogden <sup>1</sup> .....	75	32	51.2	0.74						Glenville <sup>1</sup> .....	83	22	55.0	2.95					
Parkville <sup>1</sup> .....	80	27	56.6	2.71						Parowan <sup>1</sup> .....	77	35	55.6	0.95						Grafton <sup>1</sup> .....	82	23	54.4	5.23					
Pikeville <sup>1</sup> .....	84	21	58.8	0.70						Promontory <sup>1</sup> .....	72	28	47.5	0.50						Harpers Ferry <sup>1</sup> .....	83	22	55.0	2.95					
Riddellton <sup>1</sup> .....	80	24	57.5	2.24						Provo City <sup>1</sup> .....			45.7	0.36						Hinton <sup>1</sup> .....				4.95					
Rockwood <sup>1</sup> .....				0.62						Randolph <sup>1</sup> .....	71	12	41.8	.....						Huntington <sup>1</sup> .....	81	25	55.0	6.25					
Rogersville <sup>1</sup> .....	79	27	53.8	4.36						Richfield <sup>1</sup> .....	75	22	47.9	0.04						Kingwood <sup>1</sup> .....	80	23	51.2	1.45					
Rugby <sup>1</sup> .....	79	24	53.8	1.44						Saint George <sup>1</sup> .....	90	26	57.7	0.09						Marlington <sup>1</sup> .....	81	16	51.6	5.32					
Savannah <sup>1</sup> .....	82	23	58.7	1.07						Seefeld <sup>1</sup> .....	74	5	35.4	.....						Martinsburg <sup>1</sup> .....	82	25	52.8	4.75					
Springdale <sup>1</sup> .....	88	23	59.4	2.35						Singletree <sup>1</sup> .....	71	18	40.6	T.						Morgantown <sup>1</sup> .....	85	22	55.3	2.89					
Strawberry Plains <sup>1</sup> .....				2.70						Snowflake <sup>1</sup> .....	77	18	45.6	0.47						Morgantown <sup>1</sup> .....	86	26	56.5	5.12					
Trenton <sup>1</sup> .....	84	30	56.6	2.32						Terrace <sup>1</sup> .....	78	30	49.5	0.12						Nuttallburg <sup>1</sup> .....	83 <sup>a</sup>	28	57.7	6.50					
Tullahoma <sup>1</sup> .....	78	26	55.4	2.75						Thistle <sup>1</sup> .....				0.12						Parkersburg <sup>1</sup> .....	85	30	54.7	4.48					
Waynesboro <sup>1</sup> .....	83	23	55.1	0.90						<i>Vermont.</i>										Phillippi <sup>1</sup> .....	85	24	49.4	4.91					
Wier <sup>1</sup> .....	81	23	55.9	1.83						Brattleboro <sup>1</sup> .....	77	23	51.6	3.42						Point Pleasant <sup>1</sup> .....	86	26	55.1	6.26					
<i>Texas.</i>																													



Received too late for publication in September, 1893.

Stations.	Temperature. (Fahrenheit.)			Precip'n.	Stations.	Temperature. (Fahrenheit.)			Precip'n.
	Max.	Min.	Mean			Max.	Min.	Mean	
<i>Alabama.</i>	0	0	0	<i>Ins.</i>	<i>Iowa.</i>	0	0	0	<i>Ins.</i>
Gadsden.....	96	49	73.8	.....	Council Bluffs.....	94	32	64.2	1.53
<i>Alaska.</i>					<i>Kansas.</i>				
Coal Harbor†.....	64	35	49.9	.....	Havensville*†11.....	96	34	67.0	3.16
Killisnoo†1.....	63	34	47.6	8.35	Lawrence1.....	99	41	69.2	4.40
Metlakatla†.....	68	32	51.7	8.09	<i>Mississippi.</i>				
<i>Arizona.</i>					Columbus†.....	105	49	75.5	5.67
Arizona Canal Co.					Palo Alto†1.....	92	52	72.4	8.20
Dam.....	105	62	84.4	1.32	<i>Montana.</i>				
Chiricahua Mts†.....				0.00	Choteau†.....	96	31	55.7	1.93
Phoenix of.....	108	45	79.0	0.00	<i>Nebraska.</i>				
<i>California.</i>					Cooleyton.....				0.70
Barstow†.....	98	40	66.6	0.00	Ogallala†.....	109	28	64.4	.....
Florin*2.....	89	43	63.4	0.31	Red Cloud.....				2.57
Glendora.....				T.	<i>New York.</i>				
Gridley*1.....	92	44	64.6	0.58	Lyons1.....	78	40	58.3	2.03
Hendersons Ranch.....				0.22	Watkins.....	89	32	63.0	3.07
Mountain View.....				0.13	Wedgwood1.....	82	33	55.8	2.83
Redlands a.....				0.69	<i>North Carolina.</i>				
San Bernardino†.....	95	42	67.0	0.05	Marion†.....	90	46	68.3	9.74
Saticoy†.....				0.00	Warrenton.....				4.99
Sneddens Ranch.....				0.03	<i>North Dakota.</i>				
Tulare b.....				0.00	Fort Berthold1.....	95	17	60.2	0.69
<i>Colorado.</i>					Power†12.....	92	21	61.4	0.55
Colbran.....				1.39	<i>Pennsylvania.</i>				
East Dale.....				2.00	Beaver Dam†.....				1.32
Manhattan*2.....	20	49.8	0.75		<i>Utah.</i>				
<i>Georgia.</i>					Logan†.....	88	36	59.8	1.67
Hawkinsville†.....				1.30	<i>Mexico.</i>				
Mount Vernon†.....				5.59	Mazatlan.....	90	74	83.4	9.57
Piscola.....				1.00					

\*Extremes of temperature from observed readings of dry thermometer.

†Weather Bureau instruments.

A numeral following the name of a station indicates the hours of observation from which the mean temperature was obtained, thus:

1 Mean of 7 a. m. + 2 p. m. + 9 p. m. + 9 p. m. + 4.

2 Mean of 8 a. m. + 8 p. m. + 2.

3 Mean of 7 a. m. + 7 p. m. + 2.

4 Mean of 6 a. m. + 6 p. m. + 2.

5 Mean of 7 a. m. + 2 p. m. + 2.

6 Mean from readings at various hours reduced to true daily mean by special tables.

7 Mean from hourly readings of thermograph.

8 Mean of 7 a. m. + 2 p. m. + 9 p. m. + 3.

The absence of a numeral indicates that the mean temperature has been obtained from daily readings of the maximum and minimum thermometers.

An italic letter following the name of a station, as "Livingston a," "Livingston b," indicates that two or more observers, as the case may be, are reporting from the same station. A small Roman letter following the name of a station, or in figure columns, indicates the number of days missing from the record; for instance, "a" denotes 14 days missing.

No note is made of breaks in the continuity of temperature records when the same do not exceed two days. All known breaks, of whatever duration, in the precipitation record receive appropriate notice.

Corrections: Alabama, Clanton, August, 1893, strike out precipitation 0.20. California, Pleasanton, September, 1893, add mean temperature 61.7. Colorado, Hugo, August, 1893, add T. precipitation. Colorado, Byers, all precipitation data since opening of station appears to have been approximated. Kentucky, Hendricks, September, 1893, under head of reports received too late, strike out all data. Minnesota, August, 1893, strike out all data for Fairfield, and enter same for Fairfield, Maine. Mississippi, Thornton, July, August, and September, 1893, strike out mean temperature. New York, Plattsburg Barracks, August, 1893, make mean temperature 67.3 instead of 65.4.

Notes.—The following changes have been made in names of stations: Indian Territory, Fort Supply, changed to Oklahoma Territory. South Carolina, Evergreen, changed to Hollands Store.

Data from Canadian stations for the month of October, 1893.

Station.	Pressure.			Temperature.		Precipitation.		Prevailing direction of wind.
	Mean not reduced.	Mean reduced.	Departure from normal.	Mean.	Departure from normal.	Total.	Departure from normal.	
	Inches.	Inches.	Inches.	°	°	Inches.	Inches.	
Saint John's, N. F.....	29.89	30.03	+ .09	49.0	+ 3.2	7.11	.....	n.
Sydney, N. S.....	29.98	30.04	+ .06	50.5	+ 4.5	4.68	+ 0.38	sw.
Grindstone, G. S. L.....	29.95	29.98	.....	48.9	.....	5.42	.....	ne.
Sandy Point, N. F.....								
Halifax, N. S.....	29.93	30.06	+ .08	50.6	+ 4.6	5.62	+ 0.23	n.
Grand Manan, N. B.....	30.01	30.08	.....	49.7	.....	3.52	+ 1.16	w.
Yarmouth, N. S.....	30.00	30.05	+ .10	50.4	+ 3.9	4.44	+ 0.41	n.
Saint Andrews, N. B.....	30.00	30.04	.....	48.2	.....	3.37	+ 0.98	nw.
Charlottetown, P. E. I.....	30.00	30.04	.....	50.4	.....	6.09	+ 1.61	w.
Chatham, N. B.....	30.03	30.05	+ .09	47.1	+ 6.6	3.19	+ 0.70	w.
Father Point, Que.....	30.00	30.03	+ .07	43.7	+ 4.7	2.01	+ 0.61	w.
Quebec, Que.....	30.72	30.05	+ .06	45.8	+ 4.8	2.00	+ 1.65	w.
Montreal, Que.....	29.84	30.05	+ .05	48.4	+ 4.9	2.17	+ 1.44	so.
Rockliffe, Ont.....	29.46	29.98	+ .04	43.3	+ 4.3	2.82	+ 0.12	so.
Kingston, Ont.....	29.72	30.05	+ .02	49.6	+ 3.6	2.32	+ 0.68	sw.
Toronto, Ont.....	29.66	30.04	.....	47.8	+ 2.3	3.68	+ 1.39	w.
White River, Ont.....	28.60	29.97	.....	38.0	.....	2.07	.....	a.
Port Stanley, Ont.....	29.40	30.04	+ .01	48.4	.....	3.73	+ 0.45	w.
Saugeen, Ont.....	29.29	30.02	+ .02	47.2	+ 2.2	2.93	+ 0.88	w.
Parry Sound, Ont.....	29.30	30.01	.....	45.6	+ 3.1	5.00	+ 0.68	e.
Port Arthur, Ont.....	29.20	29.91	+ .09	49.6	+ 2.1	2.60	+ 0.09	w.
Winnipeg, Man.....	29.06	29.91	+ .08	35.3	+ 1.2	1.35	+ 0.38	w.
Minnedosa, Man.....	28.05	29.90	+ .07	33.1	+ 0.4	0.71	+ 0.85	nw.
Qu'Appelle, Assiniboia.....	27.62	29.93	+ .04	32.4	+ 4.1	1.35	+ 0.33	nw.
Medicine Hat, Assiniboia.....	27.56	29.90	+ .06	38.4	+ 3.6	0.41	+ 0.03	w.
Swift Current, Assiniboia.....	27.30	29.94	+ .05	33.0	+ 4.1	1.53	+ 0.30	w.
Calgary, Alberta.....	26.32	29.93	+ .03	34.8	+ 4.2	0.74	+ 0.38	n.
Prince Albert, Sask.....	26.32	29.88	.....	29.8	.....	1.02	.....	nw.
Edmonton, Alberta.....								
Battleford, Saskatchewan.....	28.12	29.89	.....	33.1	.....	0.79	.....	nw.
Spences Bridge, B. C.....	29.16	29.99	.....	45.9	.....	1.02	.....	w.
Sable Island.....								
Hamilton, Bermuda.....	29.90	30.06	+ .04	72.2	.....	2.49	.....	ne.
<i>September, 1893.</i>								
Anticosti, G. S. L.....	29.82	29.85	+ .07	48.5	+ 1.7	2.33	.....	nw.

Climatological data for October, 1892.—Weather Bureau Stations.

Districts and stations.	Elevation above sea-level, feet.	Length of record, years.	Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.				Humidity and precipitation.				Wind.				Mean temperature data since opening of station.														
			Mean pressure, 8 a. m. and 8 p. m. + a.	Mean reduced.	Departure from normal.	Mean max. and min. + a.	Departure from normal.	Maximum.	Minimum.	Date.	Mean maximum.	Mean minimum.	Greatest daily range.	Mean temperature of the day-point.	Mean relative humidity, per cent.	Precipitation, in inches.	Departure from normal.	Days with or more.	Total movement, miles.	Prevailing direction.	Maximum velocity.			Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Highest for month.	Year.	Lowest for month.	Year.	
																					Miles per hour.	Direction.	Date.									
New England.																																
Eastport.....	53	21	29.99	30.06	+ .05	53.0	2.2	65	6	55	32	31	45	30	43	81	1.3	1.3	9	8,136	S.W.	42	24	7	11	13	6.4	50.3	1876	43.7	1888	
Portland.....	103	22	29.97	30.07	+ .10	49.8	3.5	75	9	57	30	31	44	24	40	86	1.5	1.1	10	5,689	N.W.	36	14	18	9	7	4.8	55.5	1879	43.4	1888	
Manchester.....	247	7	29.94	30.10	+ .16	52.4	3.4	76	9	63	23	31	42	39	41	73	3.22	0.5	7	4,068	S.W.	30	14	13	10	5	5.6	47.6	1893	44.0	1888	
Northfield.....	872	7	29.15	30.10	+ .04	47.6	3.5	76	12	58	14	31	37	43	40	81	1.54	1.2	10	7,399	S.W.	30	14	10	10	5	5.9	50.0	1879	47.4	1888	
Boston.....	125	23	29.98	30.12	+ .14	54.8	3.3	79	9	62	30	31	48	28	44	72	2.97	1.3	5	7,959	S.W.	49	12	12	12	10	6.3	58.1	1879	49.4	1888	
Nantucket.....	14	7	30.11	30.12	+ .03	54.2	3.4	69	7	59	39	31	50	17	48	81	2.14	2.6	8	8,543	E.	49	14	10	6	4	5.3	58.1	1879	49.4	1888	
Woods Holl.....	16	7	30.11	30.12	+ .03	54.8	3.4	69	14	60	35	31	49	19	49	83	1.66	2.2	8	10,550	S.W.	50	14	10	6	4	5.3	58.1	1879	49.4	1888	
Vineyard Haven.....	7	7	30.11	30.12	+ .03	54.2	3.4	69	9	63	37	31	50	21	49	83	2.22	2.1	6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
Block Island.....	27	14	30.09	30.12	+ .01	54.7	3.4	68	14	59	35	31	50	17	49	83	2.75	1.6	5	9,122	S.W.	48	15	15	4	7	5.7	58.1	1879	49.7	1888	
Narragansett Pier.....	12	12	30.09	30.12	+ .01	54.7	3.4	68	14	59	35	31	50	17	49	83	2.75	1.6	5	9,122	S.W.	48	15	15	4	7	5.7	58.1	1879	49.7	1888	
New Haven.....	107	21	29.99	30.11	+ .12	54.2	3.4	71	9	62	28	31	46	26	44	71	4.75	0.7	6	6,377	S.W.	50	14	15	6	4	5.8	58.1	1879	49.7	1888	
New London.....	47	23	30.00	30.11	+ .11	54.0	3.4	71	9	62	31	31	47	25	44	71	2.20	2.7	5	5,952	N.W.	53	14	13	14	4	4	5.8	58.1	1879	49.3	1888
Mid. Atlantic States.																																
Albany.....	80	30	30.02	30.12	+ .10	53.7	3.0	75	9	62	28	31	45	34	45	79	1.67	1.8	7	5,493	S.	48	14	12	9	10	4.9	55.4	1882	45.6	1888	
New York, N. Y.....	185	23	29.92	30.12	+ .20	57.6	2.1	76	9	65	34	31	50	28	48	75	5.28	1.8	8	7,439	N.W.	48	14	17	7	7	3.7	59.8	1879	49.7	1888	
Harrisburg.....	377	6	29.71	30.13	+ .42	55.0	.....	82	9	63	25	31	47	32	48	82	3.25	.....	9	5,316	N.W.	48	13	13	7	4	4.9	58.5	1888	50.2	1876	
Philadelphia.....	117	23	30.00	30.12	+ .12	57.6	2.1	76	9	65	33	31	50	26	46	73	3.32	0.4	9	7,298	N.W.	55	13	12	11	8	4.5	61.4	1879	50.4	1876	
Atlantic City.....	53	20	30.07	30.12	+ .05	57.6	2.1	76	7	63	30	31	50	23	50	79	1.74	1.6	9	7,956	N.W.	44	13	12	11	6	4.6	61.2	1881	50.8	1876	
New Brunswick.....	.....	.....	.....	.....	.....	54.4	.....	78	9	64	24	31	44	33	47	75	4.15	.....	7	.....	N.W.	40	13	15	4	9	3.9	63.1	1881	51.7	1876	
Baltimore.....	179	23	29.91	30.11	.....	57.0	.....	78	9	65	31	31	49	32	47	75	3.44	0.4	9	5,350	N.W.	40	13	15	4	9	3.9	63.1	1881	51.7	1876	
Washington, D. C.....	112	23	30.00	30.12	.....	56.5	.....	83	9	66	26	31	47	34	47	77	4.11	0.8	7	4,473	N.W.	42	13	15	6	7	3.8	62.7	1881	50.7	1876	
Cape Henry.....	20	.....	.....	.....	.....	61.4	.....	78	9	67	43	31	50	24	.....	.....	2.10	1.7	7	.....	N.W.	42	18	6	7	.....	67.7	1881	57.1	1876		
Lynchburg.....	685	23	29.39	30.14	+ .03	56.7	1.6	84	9	66	28	31	47	36	49	86	2.17	1.4	12	5,817	N.W.	43	18	13	10	4	4.4	65.2	1881	53.6	1876	
Norfolk.....	57	23	30.04	30.11	.....	61.8	.....	83	9	68	40	30	55	27	53	80	2.85	1.1	8	5,993	N.W.	48	13	17	6	8	4.4	65.6	1881	50.2	1876	
S. Atlantic States.																																
Charleston.....	773	14	29.27	30.09	.....	60.4	.....	85	9	70	32	31	51	29	50	76	5.10	0.8	10	4,821	N.W.	32	13	16	7	8	4.4	66.4	1884	56.8	1891	
Hatteras.....	11	13	30.07	30.09	.....	65.0	.....	78	13	69	46	31	61	13	58	81	7.10	0.7	9	10,650	N.W.	30	13	9	12	10	5.8	70.8	1881	61.7	1889	
Kittyhawk.....	9	15	30.06	30.07	.....	62.9	1.5	78	9	67	47	30	59	20	56	79	1.01	3.1	9	13,048	N.W.	58	13	17	7	7	3.9	68.3	1881	58.7	1876	
Raleigh.....	388	7	29.69	30.11	+ .04	59.6	0.6	84	9	68	31	31	57	28	51	80	5.57	0.7	9	4,651	N.W.	36	13	20	5	6	3.5	60.3	1890	55.8	1889	
Southport.....	34	18	30.02	30.05	.....	61.4	0.5	80	25	72	37	31	51	25	61	88	4.94	0.6	9	7,507	N.W.	34	13	17	4	10	4.0	69.9	1881	60.4	1891	
Wilmington.....	78	23	29.99	30.09	.....	68.2	0.5	82	9	72	38	31	56	24	56	81	3.20	0.7	9	6,558	N.W.	56	13	15	9	7	3.8	69.8	1881	59.0	1876	
Charleston.....	52	23	30.00	30.05	.....	68.2	0.5	83	1	75	43	31	61	22	58	77	7.51	3.2	7	7,415	N.W.	60	12	14	13	4	3.8	72.0	1881	62.0	1876	
Columbia.....	7	.....	.....	.....	.....	64.6	.....	89	6	74	33	31	55	30	.....	.....	2.48	0.2	9	.....	N.W.	56	10	9	6	.....	65.7	1892	59.7	1891		
Augusta.....	209	22	29.88	30.11	.....	65.0	0.7	87	10	75	33	31	55	29	54	75	4.56	1.9	5	3,985	N.W.	27	13	18	7	6	3.3	70.6	1881	59.4	1875	
Savannah.....	98	23	29.95	30.05	.....	68.2	0.5	85	10	77	41	31	60	24	59	81	6.91	3.1	6	6,988	N.W.	40	14	15	12	4	3.4	72.4	1881	62.1	1876	
Jacksonville.....	43	23	29.97	30.02	.....	70.9	0.6	88	4	80	45	31	62	26	61	78	4.48	1.2	10	6,496	N.W.	39	13	12	9	10	4.9	74.7	1881	65.7	1876	
Florida Peninsula.																																
Jupiter.....	26	6	29.91	29.94	.....	77.3	.....	90	3	83	64	31	72	18	72	85	11.72	.....	15	10,321	N.W.	72	11	8	11	12	6.0	77.3	1893	73.6	1891	
Key West.....	21	23	29.93	29.95	.....	79.2	0.2	88	3	83	68	19	76	13	72	79	3.75	1.5	13	9,404	N.W.	32	12	10	13	8	5.3	80.3	1881	76.0	1891	
Tampa.....	36	.....	.....	.....	.....	74.4	.....	88	9	83	57	31	66	22	65	80	2.40	.....	9	5,743	N.W.	31	12	10	16	5	5.1	80.3	1881	76.0	1891	
Titusville.....	44	7	29.95	29.99	.....	73.8	.....	91	4	80	60	14	68	21	67	80	8.67	3.0	14	10,766	N.W.	70	11	11	15	5	5.1	74.8	1887	69.4	1889	
Eastern Gulf States.																																
Atlanta.....	1,131	16	29.91	30.11	.....	61.6	0.4	84	1	71	34	31	52	29	48	68	0.39	2.4	3	7,526	N.W.	38	13	26	6	5	2.9	67.8	1884	56.5	1885	
Pensacola.....	56	14	29.98	30.04	.....	68.2	1.5	88	1	78	44	30	52	29	55	70	4.07	0.9	9	7,566	N.W.	68	2	21	5	5	2.8	73.8	1884	64.7	1885	
Mobile.....	57	23	29.99	30.05	.....	66.3	0.2	88	7	76	42	31	56	29	56	79	1.51	5.3	5	6,174	N.W.	72	2	19	7	3	3.1	73.5	1881	62.7	1875	
Montgomery.....	257	22	29.79	30.07	.....	64.8	2.2	86	10	76	35	31	54	33	51	71	8.20	1.5	4	4,483	N.W.	36	2	20	5	6	3.7	71.3	1884	60.4	1875	
Meridian.....	358	.....	.....	.....	.....	61.2	.....	88	11	74	33	31	48	40	51	80	1.68	.....	4	3,412	N.W.	28	2	21	5	5	2.5	.....	.....	.....	.....	
Vicksburg.....	254	23	29.81	30.08	.....	64.6	2.4	86	11	75	36	30	54	28	49	66	1.50	1.5	4	4,318	N.W.	34	14	6	25	4	2	71.2	1883	60.5	1875	
New Orleans.....	54	23	30.00	30.06	.....	69.1	1.6	86	11	76	48	30	62	19	57	71	4.24	0.8	6	7,222	N.W.	48	1	23	5	3	2.1	75.4	1883	65.7	1885	
Western Gulf States.																																
Shreveport.....	249	23	29.81	30.08	.....	65.3	0.7	90	1	78	40	16	52	33	48	63	0.69	2.7	2	4,655	N.W.	60	5	26	5	0	1.2	70.9	1883	60.9	1885	
Fort Smith.....	492	12	29.57	30.09	.....	61.0	1.7	88	2	75	34	37	47	37	46	65	1.57	1.9	6	5,487	N.W.	35	5	24	2	5	2.6	65.5	1882	57.2	1885	
Little Rock.....	302	15	29.77	30.09	.....	60.6	3.1	87	2	73	37	30	48	34	46	66	1.56	1.0	4	4,584	N.W.	35	5	20	3	2	1.7	67.8	1881	58.8	1885	
Corpus Christi.....	20	7	30.05	3																												



## Climatological data for October, 1893—Weather Bureau Stations—Continued.

Districts and stations.	Elevation above sea-level, feet.	Length of record, years.	Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.					Humidity and precipitation.					Wind.				Mean temperature data since opening of station.									
			Mean pressure, 8 a. m. and 8 p. m. + 2.	Mean reduced.	Departure from normal.	Mean max. and min. + 2.	Departure from normal.	Maximum.	Date.	Mean minimum.	Date.	Greatest daily range.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.	Departure from normal.	Days with $\frac{1}{10}$ or more.	Total movement, miles.	Prevailing direction.	Maximum velocity.	Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Highest for month.	Year.	Lowest for month.	Year.	
<i>Up. Miss. Val.—Con.</i>																													
Lavenport.....	613	22	29.34	29.99	— .08	54.7	+ 2.5	82	11 64	24 30	45 30	41	69	0.80	— 2.2	7	7,446	s.	48	w.	6	13	11	7	4.6	59.8	1879	47.5	1887
Des Moines.....	869	16	29.05	29.99	— .07	54.8	+ 3.0	86	10 66	22 30	43 38	40	62	0.22	— 3.4	5	6,618	nw.	36	nw.	23	18	13	0	3.5	59.6	1879	48.4	1887
Dubuque.....	651	21	29.27	29.98	— .07	53.2	+ 2.4	82	10 63	22 30	43 34	43	77	1.66	— 1.4	4	4,358	nw.	26	nw.	6	10	8	13	5.3	58.7	1879	46.3	1887
Keokuk.....	613	23	29.35	30.01	— .06	50.6	+ 2.6	90	1 68	27 30	40 35	42	65	0.33	— 2.9	4	5,303	nw.	36	w.	6	21	7	3	2.4	61.6	1879	49.4	1887
Cairo.....	359	23	29.71	30.10	+ .01	57.9	+ 1.8	84	2 67	33 29	49 29	49	79	6.26	+ 3.3	7	5,093	s.	29	w.	14	24	2	5	2.2	65.2	1879	53.7	1873
Springfield, Ill.....	944	15	29.35	30.04	— .05	55.8	+ 0.8	87	9 67	24 30	44 33	42	68	0.16	— 3.3	4	7,753	s.	36	w.	6	20	5	6	3.0	62.6	1879	50.4	1887
Hannibal.....	534	23	29.44	30.02	— .02	57.0	+ 0.6	88	1 69	25 30	45 40	41	64	0.50	— 1.0	5	7,591	s.	36	sw.	6	21	7	3	3.1	62.8	1884	52.0	1887
Saint Louis.....	571	23	29.44	30.06	— .02	53.4	+ 1.6	83	1 74	39 15	44 38	40	59	0.46	— 1.7	5	6,030	se.	36	s.	31	23	7	1	1.8	59.0	1892	54.6	1888
<i>Missouri Valley.</i>																													
Columbia.....	963	6	28.99	30.02	— .03	58.8	+ 0.6	90	9 70	32 28	47 33	40	58	0.10	— 2.2	2	7,395	sw.	28	nw.	13	21	9	1	2.6	59.0	1892	54.6	1888
Kansas City.....	1,356	8	28.02	30.06	— .01	57.6	+ 0.6	91	1 69	31 29	40 32	41	63	1.15	— 2.2	4	8,005	se.	36	nw.	14	24	5	2	2.0	61.2	1882	54.2	1888
Leavenworth.....	857	23	29.11	30.03	— .04	58.2	+ 2.2	90	9 70	30 28	46 37	40	59	0.48	— 2.8	2	7,866	s.	36	nw.	11	16	13	2	3.3	62.0	1879	50.6	1873
Bopeka.....	7	7	27.25	30.00	— .05	55.7	+ 1.4	88	9 72	30 28	46 40	36	57	0.25	— 1.9	3	6,240	nw.	33	n.	11	20	7	4	3.4	61.5	1879	49.1	1888
Omaha.....	1,123	23	28.80	30.00	— .08	55.4	+ 2.6	89	9 66	24 28	44 35	36	57	0.12	— 2.5	3	7,884	nw.	48	n.	11	20	7	4	3.4	61.5	1879	49.1	1888
Valentine.....	2,613	9	27.25	29.99	— .05	47.4	+ 1.9	82	8 63	14 28	33 56	30	60	0.23	— 1.0	4	7,884	w.	48	n.	11	14	9	6	5.1	52.0	1886	44.6	1887
Sioux City.....	1,165	23	28.72	29.98	— .06	51.2	+ 0.6	86	8 63	21 15	39 41	35	66	0.58	— 0.9	9	7,803	nw.	34	n.	11	17	7	7	4.0	59.0	1886	44.6	1887
Pierre.....	1,470	23	28.39	29.98	— .06	48.6	+ 0.6	82	16 61	20 25	30 51	34	69	1.57	— 1.2	5	5,763	nw.	36	nw.	12	16	11	4	4.5	51.6	1892	42.2	1887
Huron.....	1,310	13	28.54	29.97	— .06	45.7	+ 0.8	81	16 61	12 28	31 53	30	64	0.19	— 1.2	5	9,870	nw.	51	w.	3	15	10	0	4.4	51.6	1892	42.2	1887
Yankton.....	1,232	21	28.65	29.98	— .05	50.8	+ 0.6	85	8 63	21 28	38 44	34	64	0.80	— 0.6	6	6,549	nw.	35	s.	10	13	14	4	4.0	58.9	1879	45.2	1876
<i>Northern Slope.</i>																													
Havre.....	2,477	14	27.29	29.94	— .08	40.8	+ 2.7	70	15 51	13 23	30 42	30	69	1.40	+ 0.9	14	7,243	sw.	40	sw.	7	4	14	13	6.4	49.0	1889	30.2	1881
Miles City.....	2,374	16	27.42	29.95	— .09	44.4	+ 1.7	70	21 55	24 24	33 44	31	68	1.25	+ 0.4	11	3,117	nw.	17	s.	12	7	10	15	6.0	51.1	1889	37.0	1883
Helena.....	4,118	14	25.79	30.00	— .00	42.2	+ 2.6	67	21 50	20 23	34 33	30	71	0.84	+ 0.0	11	3,884	sw.	48	sw.	12	7	10	14	5.9	50.7	1886	37.9	1881
Rapid City.....	3,280	8	26.59	30.00	— .01	46.8	+ 2.8	84	9 59	20 29	34 49	29	60	1.01	+ 0.5	6	6,674	w.	36	nw.	12	13	10	8	4.8	51.7	1892	44.4	1888
Cheyenne.....	6,105	23	24.02	30.05	— .02	46.8	+ 2.8	84	9 59	20 29	34 49	28	56	0.22	— 0.5	4	8,003	nw.	44	nw.	7	12	17	2	4.1	48.3	1875	39.3	1885
Lander.....	5,377	23	24.63	30.07	— .02	43.5	+ 2.0	91	8 72	21 20	34 48	39	64	0.14	— 1.5	3	8,278	s.	30	n.	17	24	6	1	1.9	59.7	1886	50.9	1885
Kearney.....	2,406	23	27.69	30.03	— .03	51.4	+ 0.6	85	8 65	24 38	42 33	60	33	0.42	— 1.0	1	9,327	w.	48	n.	11	20	6	5	3.0	59.0	1884	50.8	1883
North Platte.....	2,841	20	27.07	30.00	— .01	49.5	+ 0.7	89	8 66	19 26	34 50	30	57	0.05	— 1.1	2	7,128	nw.	36	n.	11	11	17	3	3.9	55.2	1879	44.5	1877
<i>Middle Slope.</i>																													
Colorado Springs.....	6,098	12	24.04	30.07	— .01	48.4	+ 1.5	76	8 63	14 26	34 40	25	48	0.24	— 0.4	4	6,813	n.	55	nw.	23	19	11	1	3.2	51.3	1875	44.0	1883
Denver.....	5,287	22	24.77	30.05	— .01	51.4	+ 0.7	81	8 60	23 26	37 44	22	37	0.84	+ 0.0	4	5,357	s.	36	ne.	25	14	15	2	4.1	55.5	1884	45.7	1873
Pikes Peak.....	15	16	27.80	30.00	— .00	31.2	+ 0.0	40	8 67	2 26	10 22	11	66	4.10	— 0.6	6	31,370	w.	90	w.	4	17	13	1	3.3	26.2	1879	16.4	1883
Pueblo.....	4,734	6	25.27	30.04	— .00	53.0	+ 0.0	85	6 29	23 26	36 48	30	37	0.18	— 0.4	4	5,373	nw.	42	n.	11	17	12	3	3.5	53.2	1889	50.6	1890
Concordia.....	1,410	9	28.51	30.01	— .05	57.2	+ 2.4	91	8 71	20 30	44 48	39	64	0.14	— 1.5	3	8,278	s.	30	n.	17	24	6	1	1.9	59.7	1886	50.9	1885
Dodge City.....	2,523	20	27.39	30.03	— .02	50.8	+ 2.1	91	8 72	21 20	34 48	42	32	0.25	— 1.0	1	8,315	se.	46	nw.	11	27	4	0	1.9	59.0	1884	50.8	1883
Wichita.....	1,366	6	28.57	30.02	— .02	59.8	+ 0.0	91	9 74	32 29	46 40	39	54	0.02	— 1.0	1	8,151	s.	32	nw.	11	24	6	1	1.8	59.8	1893	56.4	1889
Oklahoma City.....	1,239	23	28.70	30.07	— .00	61.7	+ 0.8	88	8 70	32 27	46 39	42	58	0.06	— 0.8	1	7,670	s.	36	n.	26	30	1	0	0.5	59.0	1889	56.4	1889
<i>Southern Slope.</i>																													
Abilene.....	1,748	9	28.27	30.06	— .00	47.1	+ 1.9	94	8 79	37 27	55 32	36	40	0.03	— 3.0	1	8,416	s.	40	nw.	11	28	3	0	0.8	67.1	1893	61.7	1887
Amarillo.....	3,691	10	26.30	30.05	— .05	57.4	+ 0.3	84	9 69	35 27	46 33	32	47	0.03	— 1.5	2	12,793	s.	60	n.	11	23	7	1	2.0	59.0	1884	45.7	1887
Fort Stanton.....	6,152	10	24.03	30.07	+ .02	51.2	+ 0.3	75	9 66	27 29	36 42	24	39	0.01	— 1.5	1	4,040	w.	34	sw.	22	23	4	4	2.4	53.4	1884	48.5	1887
<i>Southern Plateau.</i>																													
El Paso.....	3,796	16	26.26	30.09	+ .04	62.9	+ 0.8	87	8 78	36 28	48 43	30	38	T.	— 1.2	0	5,251	e.	42	nw.	22	25	5	1	1.5	67.8	1878	59.8	1882
Santa Fe.....	7,051	20	23.34	30.09	+ .05	49.0	+ 0.1	90	8 81	30 2	38 32	20	37	0.22	— 0.8	4	4,511	se.	30	ne.	5	26	5	0	1.5	52.8	1875	45.7	1880
Tucson.....	2,432	9	27.49	29.99	— .01	65.5	+ 0.0	92</																					





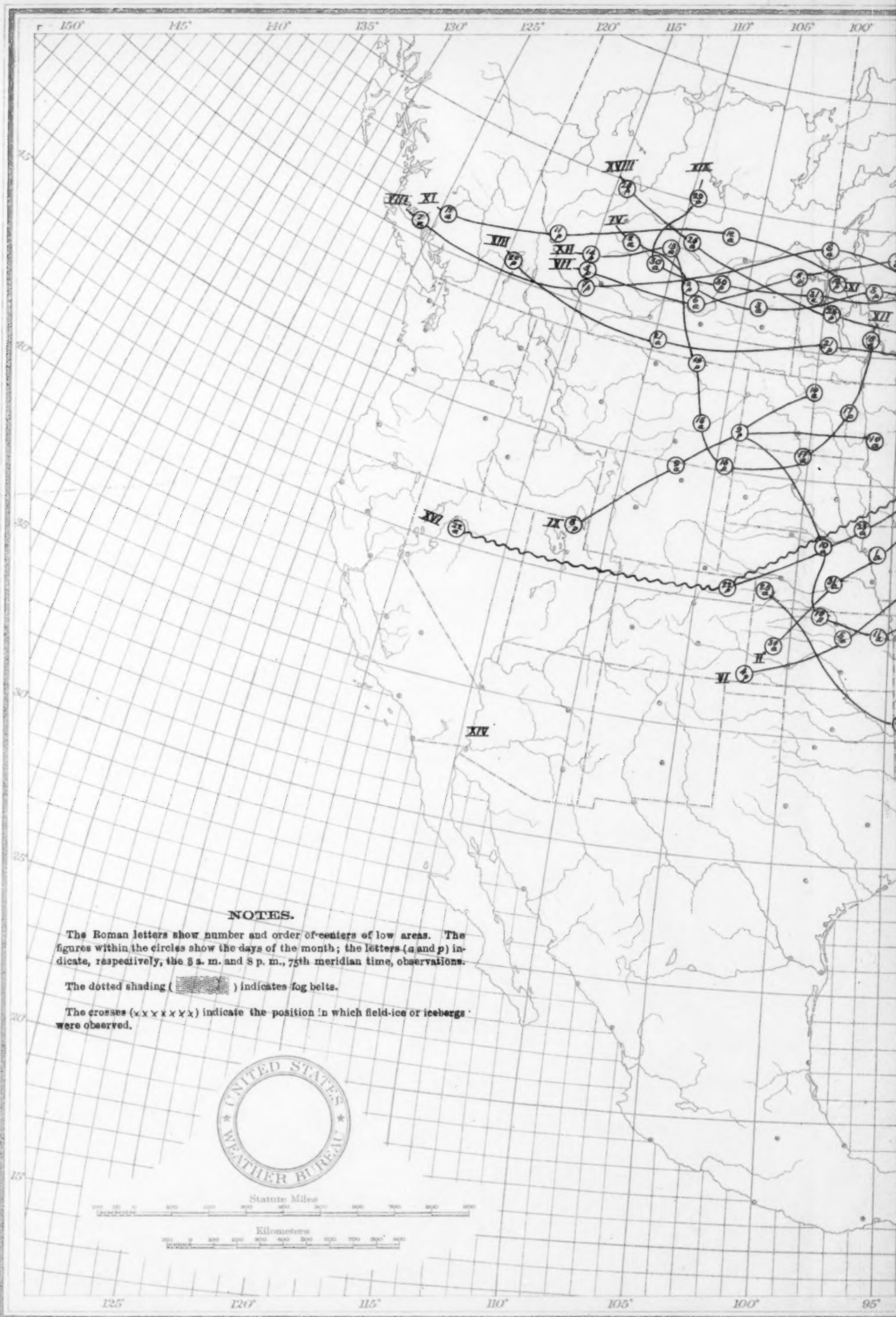
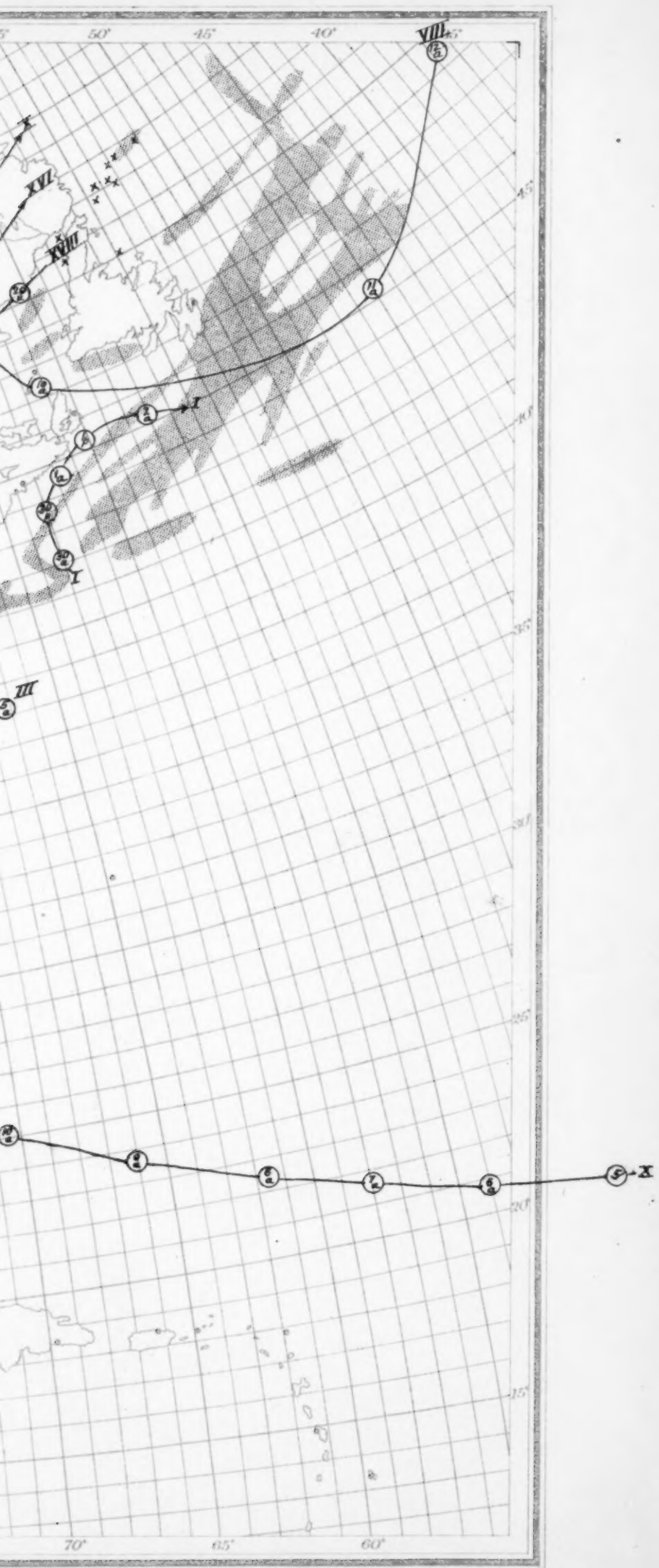


Chart I. Tracks of Centers of Low Areas. October, 1893.







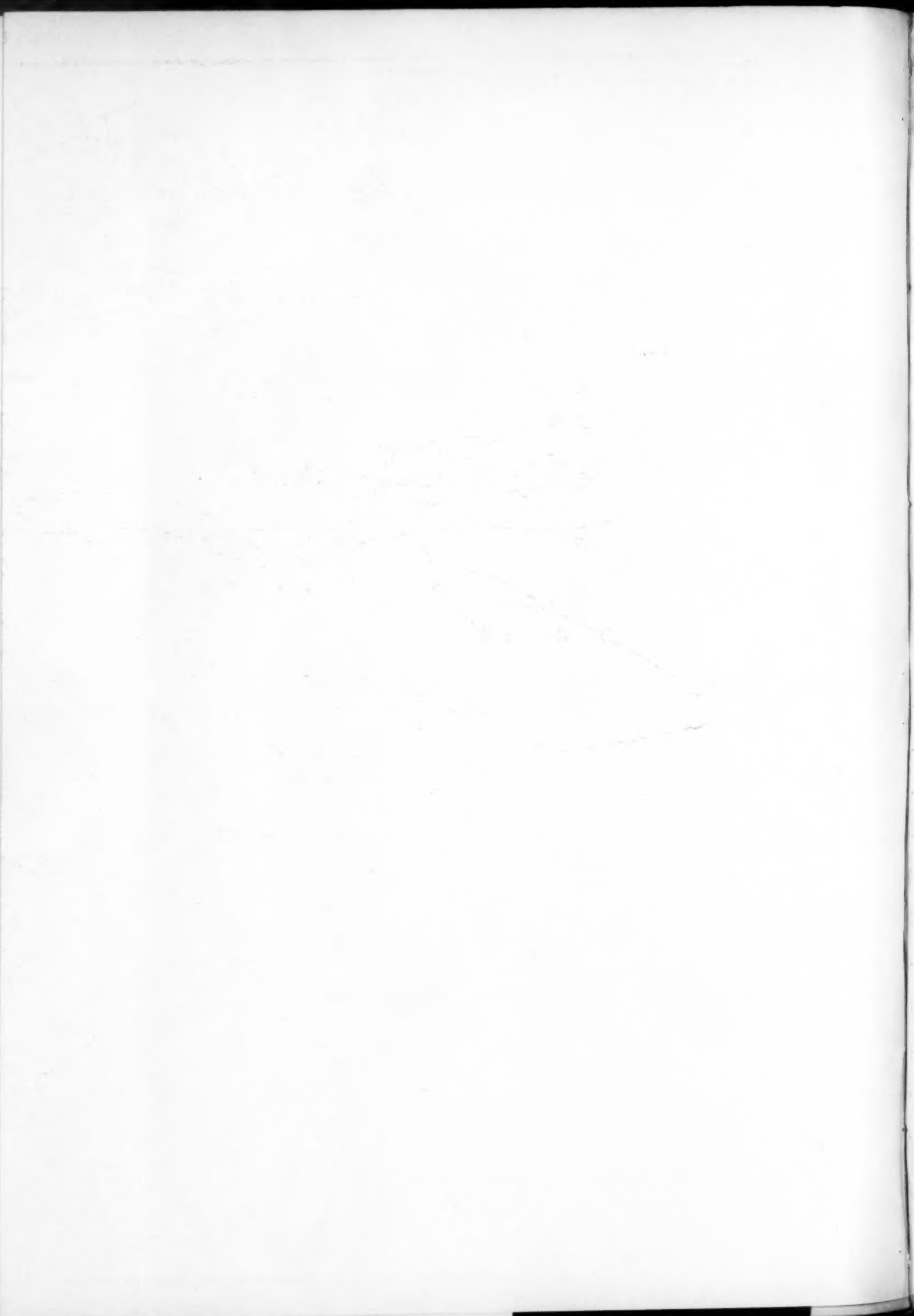
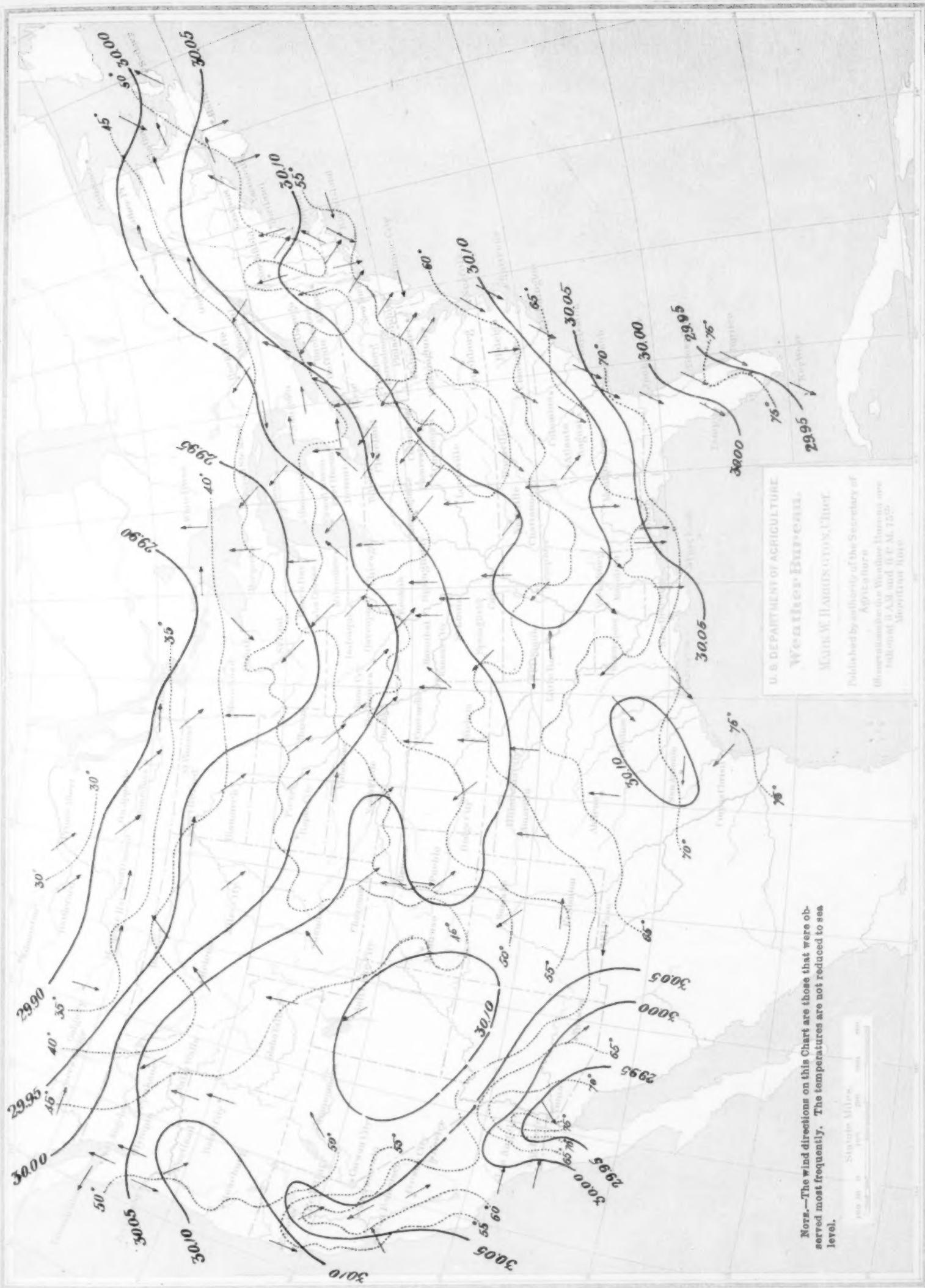




Chart II. Isobars, Isotherms, and Prevailing Winds. October, 1893.



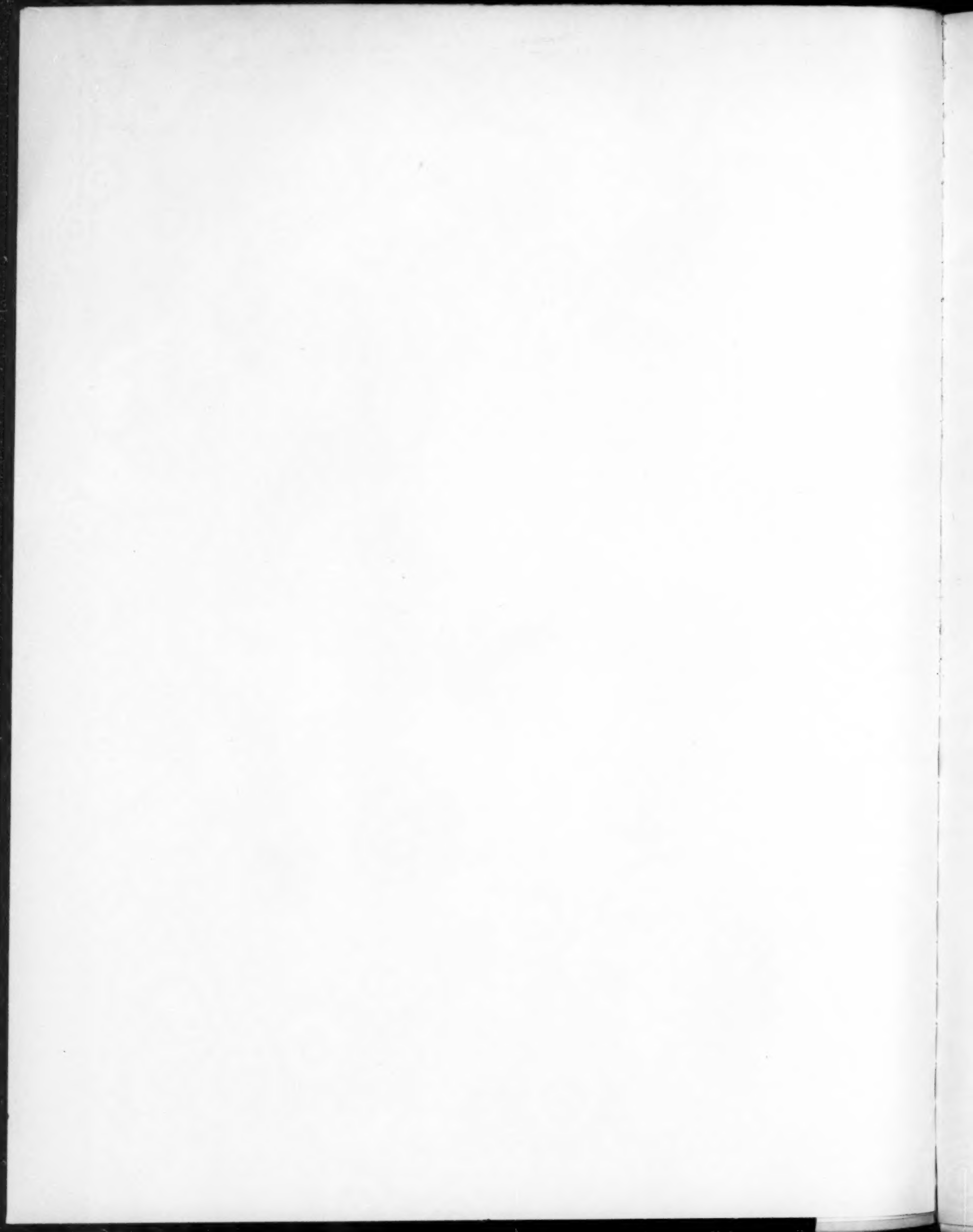




Chart III. Total Precipitation. October, 1893.

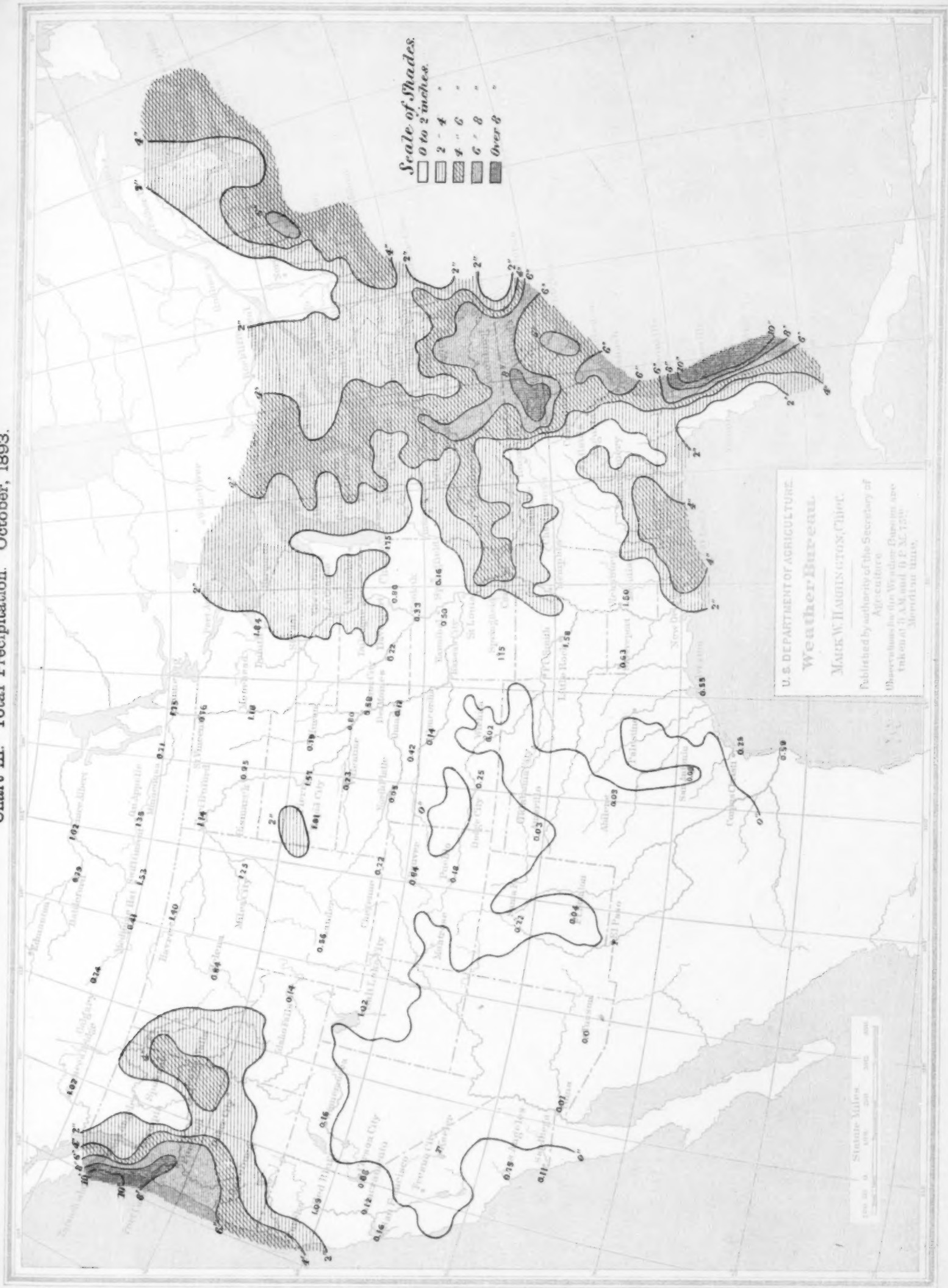
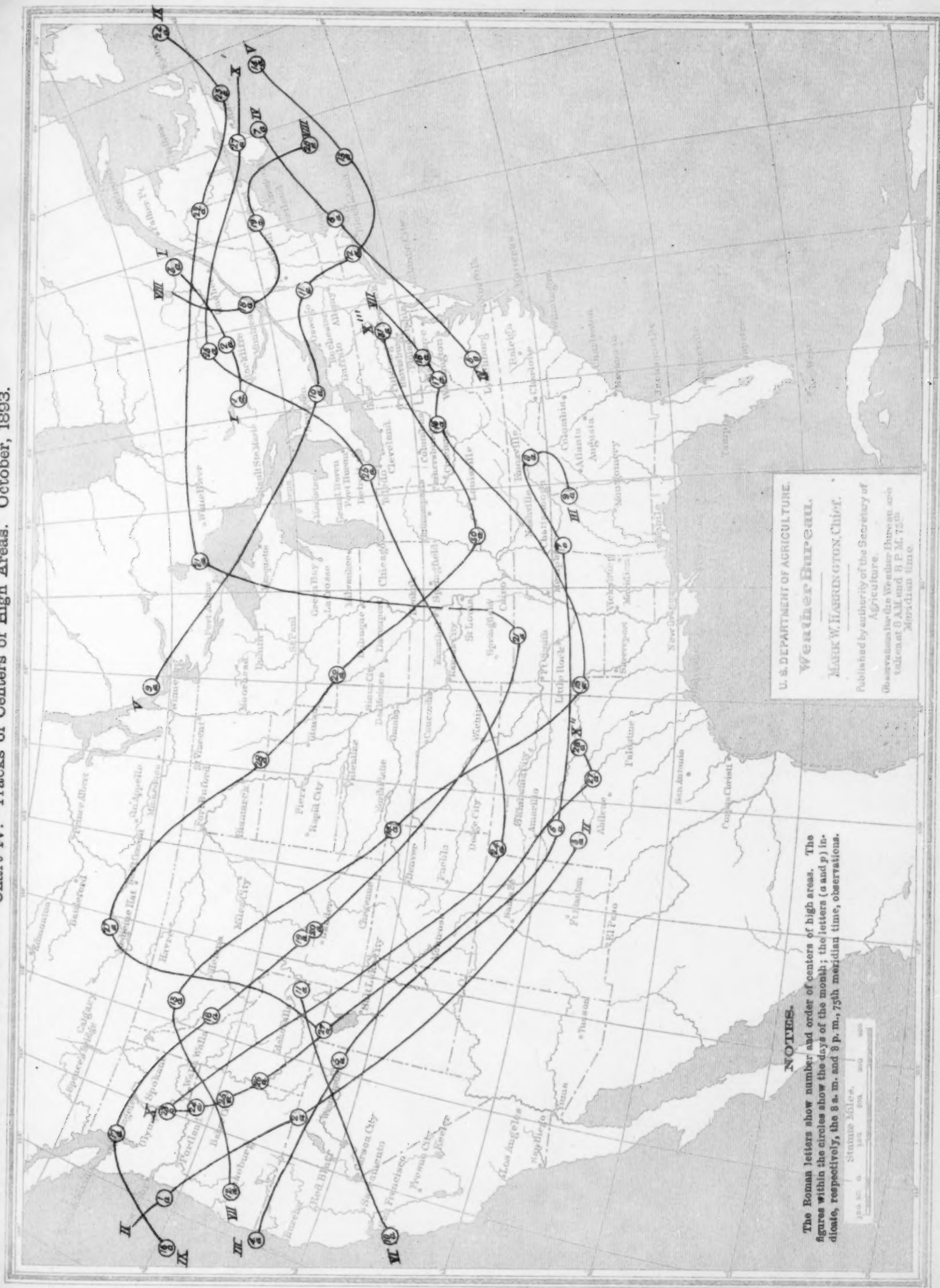






Chart IV. Tracks of Centers of High Areas. October, 1893.



U.S. DEPARTMENT OF AGRICULTURE.  
**Weather Bureau.**  
 MARK W. HARRINGTON, Chief.

Published by authority of the Secretary of  
 Agriculture.  
 Observations for the Weather Bureau are  
 taken at 8 A.M. and 8 P.M. 75th  
 Meridian time.

**NOTES.**

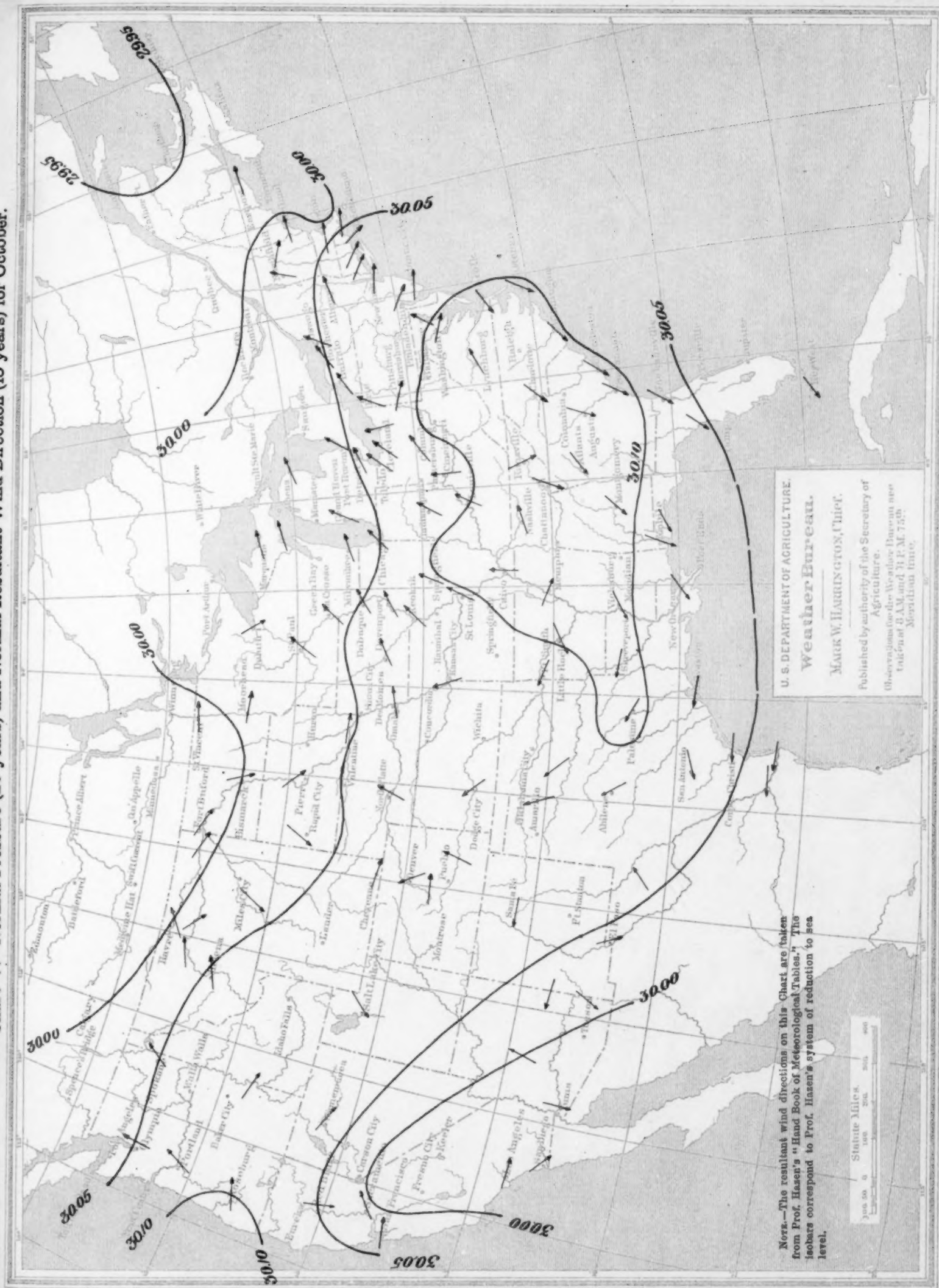
The Roman letters show number and order of centers of high areas. The  
 figures within the circles show the days of the month; the letters (a and p) in-  
 dicate, respectively, the 8 a. m. and 8 p. m., 75th meridian time, observations.

Scale in Miles.  
 0 100 200 300 400





Chart V. Normal Pressure (20 years) and Normal Resultant Wind Direction (15 years) for October.



U.S. DEPARTMENT OF AGRICULTURE.  
**Weather Bureau.**  
 MARK W. HARRINGTON, Chief.  
 Published by authority of the Secretary of  
 Agriculture.  
 Observations for the Weather Bureau are  
 taken at 3 A.M. and 3 P.M. 75th  
 Meridian time.

NOTE.—The resultant wind directions on this Chart are taken  
 from Prof. Hæser's "Hand Book of Meteorological Tables." The  
 isobars correspond to Prof. Hæser's system of reduction to sea  
 level.





Chart VI. Depth of Snowfall (inches) and Limits of Freezing Weather, October, 1893.

